

# EXHIBIT 32

IN THE UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF NORTH CAROLINA  
SOUTHERN DISTRICT  
No. 7:23-CV-897

- - - - -X  
IN RE: :  
:  
CAMP LEJEUNE WATER LITIGATION :  
:  
This Document Relates to: :  
ALL CASES :  
- - - - -X

Videotaped deposition of Mustafa Mehmet  
Aral, taken at the offices of Weitz & Luxenberg, 700  
Broadway, New York, New York, before Clifford  
Edwards, Certified Shorthand Reporter and Notary  
Public, in and for the State of New York on  
Thursday, February 6, 2025, at 9:02 a.m. EST.

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202-514-2000

1 A P P E A R A N C E S:

2 (continued)

3  
4 ALSO PRESENT:

5 Ingrid Rodriguez, videographer

6  
7 VIA ZOOM:

8 Alex Spiliotopoulos (via Zoom)

9 Bill Williams (via Zoom)

10 Corissa O'Neill (via Zoom)

11 Deanna Havai (via Zoom)

12 Dennis Reich (via Zoom)

13 Ed Bell (via Zoom)

14 Morris Maslia (via Zoom)

15 Giovanni Antonucci, DOJ (via Zoom)

16 Haroon Anwar, DOJ (via Zoom)

17 Kailey Silverstein, DOJ (via Zoom)

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25

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(Reporter's Note: Exhibits retained by the court  
reporter and forwarded to Golkow for production.)

1 THE VIDEOGRAPHER: We are now on the  
2 record.

3 My name is Ingrid Rodriguez. I'm a  
4 videographer for Golkow Litigation  
5 Services.

6 Today's date is February 6, 2025,  
7 and the time is 9:03 a.m. This video  
8 deposition is being held at Weitz &  
9 Luxenberg, in New York, New York, in the  
10 matter of In Re: Camp Lejeune Water  
11 Litigation in the United States District  
12 Court for the Eastern District of North  
13 Carolina.

14 The deponent is Professor Mustafa  
15 Aral.

16 Would counsel please state your  
17 appearances for the record?

18 MS. O'LEARY: Allison O'Leary for  
19 the Department of Justice.

20 MS. HORAN: Alana Horan for  
21 Department of Justice.

22 MR. DEAN: Good morning. Kevin Dean  
23 here on behalf of the plaintiffs.

24 MS. BAUGHMAN: Laura Baughman for  
25 the plaintiffs.



1 MS. BOLTON: Devin Bolton for the  
2 plaintiffs.

3 THE VIDEOGRAPHER: And on Zoom, I  
4 have "Alex Spiliotopoulos," "Bill  
5 Williams," "Corissa O'Neill," "Deanna  
6 Havai," "Dennis Reich," someone who's  
7 just "Ed."

8 MR. DEAN: Ed Bell.

9 THE VIDEOGRAPHER: Okay.

10 MR. BELL: Ed Bell.

11 THE VIDEOGRAPHER: "Giovanni  
12 Antonucci," "Haroon Anwar," "Kailey  
13 Silverstein," and "Morris Maslia."

14 The court reporter is Cliff Edwards  
15 and will now swear in the witness.  
16

17 MUSTAFA MEHMET ARAL,  
18 having first been duly sworn, deposed and testified  
19 as follows:

20 (Whereupon, there was a discussion  
21 off the record.)  
22

23 COURT REPORTER: All set. Thank  
24 you.  
25

1 DIRECT EXAMINATION

2

3 BY MS. O'LEARY:

4 Q I'm Allison O'Leary and I'm an attorney  
5 for the U.S. Department of Justice. Thank you for  
6 being here this morning.

7 I have a few, just kind of, logistics  
8 points to go over with you.

9 So if you don't understand a question,  
10 you can ask me to clarify. Can you do that?

11 A Sure.

12 Q And do you understand that the court  
13 reporter here is transcribing what you are saying  
14 today?

15 A Yes.

16 Q And do you understand that the  
17 videographer is also recording your deposition  
18 today?

19 A Yes.

20 Q Do you understand that your testimony in  
21 today's deposition could be used in court?

22 A Yes.

23 Q And do you understand that you are under  
24 oath to testify truthfully?

25 A Yes.

1           Q       Okay. Is there anything today that is  
2       impeding your ability to testify?

3           A       No.

4           Q       Did you do anything to prepare for  
5       today's deposition?

6           A       We had a meeting yesterday.

7           Q       When you say "we," are you re-  
8       referring --

9           A       These three attorneys on this side.

10          Q       Okay. So you are indicating the  
11       plaintiffs' attorneys?

12          A       Excuse me?

13          Q       You are -- you are indicating the  
14       plaintiffs' attorneys?

15          A       Yeah. Yeah.

16          Q       Okay.

17          A       Of course.

18          Q       And did you review any documents to  
19       prepare for today?

20          A       From yesterday to today or early --

21          Q       No, just in general.

22                   To prepare for today's deposition, did  
23       you review any --

24          A       Yeah. I --

25          Q       -- documents --

1           A       -- reviewed my expert's report.

2           Q       Your report?

3                   Did you review any other expert reports?

4           A       Much earlier --

5           Q       Okay.

6           A       -- than two days.

7           Q       Much earlier?

8                   What other reports did you review?

9           A       Probably in -- last month.

10          Q       Okay. Which reports did you review last  
11 month?

12          A       Okay. I have reviewed Dr. Konikow's  
13 report, Dr. Sabatini's report, I have reviewed Alex  
14 Spiliotopoulos' report, I have -- I have reviewed  
15 Dr. Hennat's report, Morris Maslia's report, Morris  
16 Maslia's deposition.

17                   I don't remember the name but there's a  
18 historian expert on the -- the -- the government  
19 side. I didn't review that because that's a  
20 historical review. It's not my area.

21                   I believe that's it.

22          Q       Okay. And you said you'd reviewed Morris  
23 Maslia's deposition; is that right?

24          A       Yeah.

25          Q       Was that his deposition from 2024?

1           A       I think -- let's see.

2                   No. No. It's a -- did I say a  
3 deposition?

4           Q       I thought you had said the transcript  
5 from Morris Maslia's deposition?

6           A       I read Morris Maslia's rebuttal report --

7           Q       Oh, rebuttal report?

8           A       Right.

9           Q       Okay.

10          A       I -- I was mistaken on that. And I read  
11 his expert report.

12          Q       Okay. Thank you for clarifying. You  
13 mentioned you had reviewed reports.

14                   Is there anything from your report in  
15 this case that you'd like to correct?

16          A       No.

17          Q       Okay. Did you review any reports by  
18 Norman Jones and Jeffrey Davis?

19          A       Oh, yes. That's the post audit --

20          Q       Okay.

21          A       -- study.

22                   Yes, I did review that.

23          Q       Did you read the rebuttal report and the  
24 original report by Norman Jones and Jeffrey --

25          A       Yes.

1 Q -- Davis?

2 A Both of them.

3 Q Okay. And am I correct that the only  
4 report you prepared in this is the report that came  
5 out last fall in --

6 A Yes.

7 Q -- 2024?

8 A The expert report.

9 Q Okay. So do I understand correctly that  
10 you are not offering opinions on Dr. Konikow's or  
11 Dr. Sabatini's rebuttal reports?

12 A No. I mean, I didn't write a rebuttal  
13 report to their --

14 Q Okay.

15 A -- expert report.

16 Q Okay. So you have not offered a -- a  
17 rebuttal report?

18 A No. No.

19 MS. O'LEARY: And can we get number  
20 eight?

21 I'm sorry. There will be a little  
22 delay as we pull out documents --

23 THE WITNESS: Okay.

24 MS. O'LEARY: -- and get them  
25 marked.

1 THE WITNESS: Okay.

2 (Whereupon, there was a discussion  
3 off the record.)

4 (Whereupon, Government's Exhibit Aral  
5 1, Résumé of Professor Aral, was  
6 marked for identification.)

7 BY MS. O'LEARY:

8 Q Professor Aral, I've handed you what's  
9 marked as --

10 A Can you speak a little bit --

11 Q Yeah.

12 A -- louder?

13 Q I'm sorry.

14 A Okay.

15 Q Professor Aral, I've handed you what's  
16 been marked as Government Exhibit 1.

17 Do you recognize this document?

18 A It looks like my résumé.

19 Q Okay. Is there anything on this  
20 résumé -- on this résumé that you'd like to correct?

21 A No.

22 Q Okay. And do I understand correctly that  
23 you were approached about serving as an expert in  
24 this Camp Lejeune Justice Act litigation by Morris  
25 Maslia?

1 A No. By Kevin.

2 Q Oh, by Kevin.

3 Kevin Dean?

4 A Yeah, Kevin Dean.

5 Q When was that?

6 A Probably two years ago, maybe. I'm not  
7 sure.

8 Q Okay. Why did you decide to --

9 A The -- the reason I think you mentioned  
10 Morris Maslia is that Morris Maslia introduced me to  
11 Kevin.

12 Q Oh, okay. I understand.

13 A Okay.

14 Q Thank you. And why did you decide to  
15 serve as an expert in the Camp Lejeune Justice Act  
16 litigation?

17 A Well, because I did a lot of work at Camp  
18 Lejeune.

19 Q Okay. Are there any other reasons why  
20 you decided to serve as an expert?

21 A No.

22 No.

23 Q No? Okay.

24 And am I correct that you've been  
25 retained, specifically, by the Bell Legal Group?



1           A       Yes. My contract with -- is with the  
2 Bell --

3           Q       Okay. And did --

4           A       -- Group.

5           Q       -- that contract begin in August of 2022?

6           A       Probably.

7           Q       Prob- -- okay.

8                   Prior to that contract beginning with  
9 Bell Legal Group, had you communicated, either  
10 verbally or through writing like e-mail, with anyone  
11 from the Bell Legal Group?

12          A       No.

13          Q       Had you communicated prior to being  
14 retained by the Bell Legal Group with anyone from  
15 Motley Rice?

16          A       No. No.

17          Q       And prior to being retained by the Bell  
18 Legal Group, had you communicated with any attorney  
19 related to Camp Lejeune?

20          A       No.

21          Q       Okay.

22          A       As far as I know -- I mean, I have  
23 attended expert panels. They may be there. I may  
24 have exchanged some ideas.

25                   I'm not sure.

1 Q Okay. You don't recall --

2 A No --

3 Q -- specifically?

4 A -- I don't recall.

5 Q Prior to being retained by the Bell Legal  
6 Group in the Camp Lejeune Justice Act litigation,  
7 did you have any communications with a man named  
8 Mike Partain related to Camp Lejeune?

9 A I think I communicated with -- not  
10 communicated but talked to him in year 2005, maybe.

11 Q Where was it that you spoke to him?

12 A Expert panels.

13 Q And what did you speak to Mike Partain  
14 about?

15 A I don't recall.

16 Q After the 2005 expert panel, had you  
17 communicated with Mike Partain again prior to being  
18 retained by the Bell Legal Group?

19 A No.

20 Q And prior to being retained by the Bell  
21 Legal Group, did you communicate with a person named  
22 Terry Dyer about anything related to Camp Lejeune?

23 A Terry Dyer?

24 Q Yes.

25 A No.

1           Q       Have you ever communicated with United  
2       States Senate or House of Representative members  
3       related to Camp Lejeune?

4           A       No.

5           Q       And have you ever communicated with  
6       Dr. Frank Bove about Camp Lejeune?

7           A       Yes.

8           Q       And in what sorts of contexts?

9           A       Again, expert panels, some meetings  
10       probably at the ATSDR starting from 2005.

11          Q       Okay.

12          A       But when you say "communication," this is  
13       verbal, meeting communications, not e-mails, etc.  
14       I don't --

15          Q       No, I mean both.

16                   Like --

17          A       You mean both? Okay.

18          Q       Yeah. So does that change your answer --

19          A       I may --

20          Q       -- for Mike Partain?

21          A       I may have received e-mails from ATSDR,  
22       which included his name as well.

23          Q       Included --

24          A       Frank --

25          Q       -- Mike Partain?

1 A No. No.

2 Frank Bove.

3 Q Frank Bove?

4 A Frank Bove.

5 Q Okay.

6 A Yeah.

7 Q So you may have had e-mails with Frank  
8 Bove?

9 A Yeah. Not personally exchanging e-mails  
10 but if they send e-mail to group of people, I may be  
11 included into that e-mail.

12 Q Okay. Did you ever specifically e-mail  
13 Dr. Frank Bove?

14 A No.

15 Q Okay. And did he ever send you  
16 personally an e-mail from --

17 A I don't recall.

18 Q Okay. And I understand that you were the  
19 director of the Multimedia Environmental Simulations  
20 Laboratory at Georgia Tech at some point, is that  
21 correct?

22 A That's correct.

23 Q And were the years that you were the  
24 director 1993 to 2018?

25 A That's correct.

1           Q       And how do you usually refer to the  
2 Multimedia Environmental Simulations Laboratory?

3           A       It's a reser- -- research center at --

4           Q       Do you call --

5           A       -- Georgia --

6           Q       I'm sorry. Go ahead.

7           A       Yeah.

8                   -- at Georgia Tech.

9           A       Yeah.

10          Q       Do you call it MESL or M-E-S-L?

11          A       Yeah. MESL.

12          Q       MESL?

13          A       Yeah.

14          Q       And you said it's a research center?

15          A       Yes.

16          Q       Can you explain what area of research it  
17 works on?

18          A       Groundwater modeling, surface water  
19 modeling, model development, applications off these  
20 models in different areas.

21          Q       Is it -- are there anything else it works  
22 on?

23          A       Can you repeat that --

24          Q       Yeah.

25          A       -- please?

1 Q Is there any -- are there any other areas  
2 where the MESL works?

3 A It depends on what type of projects we  
4 had during this period. I think we had a project on  
5 coastal issues at Georgia. I think we had issue --  
6 or a NSF grant to facilitate a conference related to  
7 our studies.

8 Several other projects may be included in  
9 it, which is outside the area of groundwater  
10 modeling.

11 Q And is the MESL still operating?

12 A I don't think so.

13 Q Okay. When you were the director -- so  
14 20- -- excuse me -- 1993 to 2018, how many people  
15 worked in MESL?

16 A I had about 25 Ph.D. students; they were  
17 all in there. I had -- I had about 60 master's  
18 students; they came in and went out during their  
19 master programs.

20 As a faculty member, I was the only one.

21 Q Okay. And you said about 25 Ph.D.  
22 students. Do you mean --

23 A That's right.

24 Q -- at once or during the time --

25 A Oh, during the --

1 Q -- you were the director?

2 A -- the time. It takes about five years  
3 to get the Ph.D.

4 Q And for the -- about 60 master's  
5 students --

6 A Yup.

7 Q -- is that at once or through time?

8 A Oh, through time. Of course.

9 Q Okay. Did any other professors work with  
10 MESL --

11 A I answered --

12 Q -- at a --

13 A -- that --

14 Q -- part-time --

15 (Whereupon, the court reporter  
16 requests clarification.)

17 BY MS. O'LEARY:

18 Q Yeah. Did any other professors work at  
19 MESL on a part-time basis?

20 A No.

21 Q Okay. And then I understand you became  
22 professor emeritus in 2018, is that right?

23 A Emeritus.

24 Q Emeritus?

25 A Yes.

1 Q Okay. And what is an emeritus professor?

2 A A retired professor.

3 Q Do you teach anything now?

4 A No.

5 Q When did you last teach?

6 A Retired 2019, went to Turkey. I taught  
7 there.

8 Probably 2020. In that range, yeah.

9 Q Around --

10 A I was --

11 Q -- 2000 --

12 A -- a professor there.

13 Q At -- did I understand that was not at  
14 Georgia Tech?

15 A No, it wasn't at Georgia Tech, it was in  
16 Turkey.

17 Q Okay. Do you currently supervise any  
18 graduate students?

19 A No.

20 Q And do you currently do any research?

21 A Yes.

22 Q Okay. What types of research do you do  
23 now?

24 A That's like a hobby for me. I do  
25 population analysis. I do model development in



1 different areas. A lot simpler models, but still  
2 research. Yeah.

3 Q Models related to geohydrology?

4 A Not really. Different areas.

5 Q Oh. What sorts of areas?

6 A Population --

7 Q Oh.

8 A -- topics.

9 Q Okay. I understand.

10 How else do you spend your time now?

11 A I walk a lot, I exercise a little bit, I  
12 visit my grandchildren. That's my total exposure to  
13 what I do here in New York, especially.

14 Q And I'm sorry, I didn't hear the last  
15 part?

16 A I am here in New York to visit my  
17 grandson.

18 Q Oh, okay.

19 A I live in Turkey most of the time. I  
20 live in Atlanta when I visit friends and other  
21 relatives in Atlanta.

22 Q And what city do you live in in Turkey  
23 when you are there?

24 A Istanbul.

25 Q Istanbul.

1                   What are your income sources in  
2 retirement?

3           A       My income?

4           Q       Yeah. What are the sources of your  
5 income in retirement?

6           A       Oh, retirement benefits from Georgia  
7 Tech.

8           Q       Any others?

9           A       I am paid by this task for Camp Lejeune.

10                   MS. O'LEARY: Okay. And I have a  
11 few questions about your report.

12                   So this will Be 33.

13                   So just a minute again as we pull  
14 out the exhibit.

15                   THE WITNESS: Uh-huh.

16                   (Whereupon, there was a discussion  
17 off the record.)

18                   (Whereupon, Government's Exhibit Aral  
19 2, Report by Professor Aral, was  
20 marked for identification.)

21 BY MS. O'LEARY:

22           Q       And one last question, going back to what  
23 your current research that you do on population.

24                   What is the purpose of the research you  
25 do on population?

1           A           My interest is general. It covers a lot  
2 of areas and that's one of my research interests.

3                   And I do population research, meaning how  
4 does the population change, what is the transition  
5 from one country to the other, immigration/migration  
6 and all that. And I do that in mathematical  
7 analysis.

8           Q           Okay. And why is that of interest to  
9 you?

10          A           Because I have general interests in many  
11 topics.

12          Q           Okay. So if you could go to the fourth  
13 page of your report, which is Government Exhibit 2?

14          A           Okay.

15          Q           Do you see a paragraph underneath the  
16 bullet points that starts, "Around the year 2000,  
17 the Multimedia Environmental Simulations Laboratory,  
18 MESL, a research center at the School of Civil and  
19 Environmental Engineering, Georgia Institute of  
20 Technology, entered into a cooperative agreement  
21 with the Agency for Toxic Substances and Disease  
22 Registry, ATSDR, Centers for Disease Control and  
23 Prevention, CDC, to provide technical support to  
24 ATSDR in all aspects of the Camp Lejeune study for  
25 all three study areas on an as-needed basis."

1 Did I read that correctly?

2 A Yeah.

3 Q So if that was in 2000, does that mean  
4 that when MESL started working with the ATSDR, the  
5 ATSDR's water models for Tarawa Terrace and Hadnot  
6 Point were not --

7 MR. DEAN: Also --

8 BY MS. O'LEARY:

9 Q -- yet complete?

10 MR. DEAN: Object to the form.

11 BY MS. O'LEARY:

12 Q Did you understand my question, Professor  
13 Aral?

14 A I think you didn't finish your  
15 question --

16 Q Let me -- I'll say it again.

17 MS. BAUGHMAN: I think it would be  
18 good if you would speak a little louder.

19 THE WITNESS: Yeah.

20 MS. BAUGHMAN: I don't think he can  
21 hear you.

22 THE WITNESS: Yeah. It --

23 BY MS. O'LEARY:

24 Q Sure. Yeah.

25 A I would prefer --

1 Q I'll try to --

2 A -- that, yeah.

3 Q So that section I just read --

4 A Yeah.

5 Q -- from --

6 A Yeah.

7 Q -- page four of your report, it says that  
8 MESL entered into the agreement with ATSDR in 2000.

9 MR. DEAN: Object to the form.

10 That's not what the document says.

11 BY MS. O'LEARY:

12 Q Is that correct?

13 MR. DEAN: It says "around."

14 MS. O'LEARY: That's --

15 MR. DEAN: Okay.

16 MS. O'LEARY: -- that's fine, we can  
17 make it --

18 THE WITNESS: Yeah.

19 MS. O'LEARY: -- around.

20 Is it --

21 MR. DEAN: I just want you to  
22 understand what I'm -- it's not a -- I'm  
23 not trying to interfere, but I'm just  
24 objecting to the form because that's --

25 MS. O'LEARY: Yeah.

1 MR. DEAN: You said "in 2000,"  
2 that's --

3 MS. O'LEARY: Yeah.

4 MR. DEAN: -- not what it says.

5 MS. O'LEARY: I understand. That's  
6 fair.

7 THE WITNESS: Okay.

8 BY MS. O'LEARY:

9 Q So Professor Aral, is it around 2000 that  
10 MESL entered into an agreement with ATSDR?

11 A Yes. The agreement was around 2000,  
12 yeah.

13 Q Okay. So does that mean when MESL  
14 entered into the agreement with the ATSDR, the  
15 ATSDR's models for Tarawa Terrace and the Hadnot  
16 Point-Holcomb Boulevard area were not yet complete?

17 A No, of course not.

18 Q Meaning they were -- it's true they were  
19 not yet complete?

20 A They were not completed, yeah.

21 Q Okay. And is it true that no other  
22 Georgia Tech faculty were part of the cooperative  
23 agreement between MESL and the ATSDR?

24 A There's no other faculty involved.

25 Q Did the MESL enter into cooperative

1 agreements with any other entities besides the  
2 ATSDR?

3 A Of course. Many.

4 Q Okay. What was the scope of those  
5 agreements with other entities?

6 A Other research topics, which is  
7 summarized in my résumé.

8 Q Okay. Other than in the work you did  
9 with the ATSDR on Camp Lejeune, have you ever been  
10 asked in a cooperative agreement to calculate  
11 historic contaminant levels on a monthly basis?

12 A That was the purpose of our modeling,  
13 overall.

14 Q You mean at -- at Camp Lejeune that was  
15 the purpose?

16 A Yeah, at Camp Lejeune.

17 Q Yeah?

18 A Yeah.

19 Q So other than at Camp Lejeune, did the  
20 MESL ever work on projects that were calculating  
21 historic contaminant levels on a monthly basis?

22 A We had several models which used  
23 different time frames, different time intervals.  
24 Some of them may be monthly, yeah.

25 Q Okay. Do you recall any that were --

1 A I don't recall.

2 Q -- monthly?

3 A No.

4 Q Do you recall any that were shorter time  
5 frames than monthly?

6 A Yeah, of course.

7 Q What's an example of one that was a  
8 shorter time frame?

9 A Surface water modeling that we did. We  
10 may have used shorter time frames.

11 Q Surface modeling of what?

12 A I think that was a coastal aquifer around  
13 Savannah, I believe.

14 Q And who was requesting that coastal  
15 aquifer modeling around Savannah?

16 A That was the research center at  
17 University of Georgia.

18 Q And what was the timescale on the model?

19 A I don't recall exactly but we may have  
20 used different timescales to answer different  
21 questions.

22 Q What was the purpose of that model?

23 A It's a contaminant transport analysis.

24 Q But why did they want to know about  
25 the --



1 A No.

2 Q -- contaminate --

3 A We wrote --

4 Q -- transport?

5 A -- a proposal to develop a model, a  
6 generic model in a coastal application, and they  
7 agreed to fund it.

8 Q Right. And what were they using it for?

9 A I have no idea.

10 Q Okay. And was that a historical model?

11 A It's a groundwater model. A research  
12 center proposes a topic --

13 Q Uh-huh.

14 A -- to a funding agency. If they like it,  
15 they approve it; if they don't like it, they reject  
16 it.

17 Q And what you proposed, was that to do  
18 a -- a model that would look at times in the past or  
19 look at going forward?

20 A No. It was a generic model. It can be  
21 used for the time in the past and future  
22 predictions.

23 Q Okay. Do you know if it was going to be  
24 used for past predictions?

25 A I don't know what they have used it

1 for --

2 Q Okay.

3 A -- but it's a generic model.

4 Q Uh-huh.

5 A It can be used.

6 Q You can run it forwards or backwards --

7 A Yeah.

8 Q -- is that what you mean?

9 A Yeah.

10 I don't know what you mean, by the way,  
11 "backwards."

12 Q I mean, to estimate things that happened  
13 in the past.

14 A Starting from today going backwards, is  
15 that what you mean?

16 Q I mean, starting from whenever the model  
17 is calibrated to.

18 A Okay.

19 Yeah, it can be used --

20 Q To go --

21 A -- for that purpose --

22 Q -- in the --

23 A Yeah.

24 Q I'm sorry. I just --

25 A To predict -- it can be used to predict

1 historical behavior or future behavior.

2 Q From the time of calibration?

3 A Yup.

4 Q Okay. But for the coastal aquifer  
5 surface modeling project, you don't know if it was  
6 going to be used for going backwards from the time  
7 of calibration or forwards?

8 A I don't know what they have used it for.

9 Q Other than your work in Camp Lejeune,  
10 were you ever asked to calculate contaminate levels  
11 more than 25 years before the time the -- of  
12 calibration of the model?

13 A No.

14 Q Other than at Camp Lejeune, have you ever  
15 been asked to model all of mass loading, groundwater  
16 flow, contaminant fate and transport, and variable  
17 multiwell pumping mixing models?

18 A In several research applications we have  
19 worked at MESL, all of those models were developed  
20 or applied in -- in an integrated manner or a  
21 application of each model, separately. Two  
22 different ways.

23 Q I'm not sure I understand.

24 So are you saying that all of those types  
25 of models have been done at MESL at some time?

1           A       No. We use generic models as well,  
2 coming from other sources.

3           Q       But did -- did the mass loading,  
4 groundwater flow, contaminant fate and transport,  
5 and variable multiwell pumping mixing models that  
6 MESL did, were those done together in one project  
7 or were those used in --

8           A       Oh, no.

9           Q       -- individually or --

10          A       If you -- if you are referring to  
11 TechFlowMP, for example, that's a generic model we  
12 have developed --

13          Q       Uh-huh.

14          A       -- for use in different projects, not for  
15 Camp Lejeune. But we used it for Camp Lejeune as  
16 well.

17          Q       And had -- in any other projects, not  
18 Camp Lejeune so other projects -- have you used  
19 TechFlowMP in combination with modeling mass loading  
20 and groundwater flow and, like, a well pumping  
21 mixture model?

22                   MR. DEAN: Object to the form of the  
23 question.

24          A       TechFlowMP is a generic model which  
25 starts from groundwater modeling --

1 BY MS. O'LEARY:

2 Q Uh-huh.

3 A -- all the way to contaminant transport  
4 modeling, within itself.

5 Q But it doesn't involve mixing, is that  
6 correct?

7 A What do you mean by mixing?

8 Q Like, mixing of multiple wells, that's  
9 not a part of TechFlowMP.

10 A Why shouldn't it? It will, of course.

11 Q How does TechFlowMP model well mixing?

12 A Well, because you have -- in an area you  
13 have water supply wells. You put them into the  
14 model as a discharging point or a source point --

15 Q Uh-huh.

16 A -- and the whole thing is integrated in a  
17 single application.

18 Q But doesn't TechFlowMP model the  
19 contaminant movement to the wells, not the mixing of  
20 the wells?

21 A Oh, you are talking about mixing of the  
22 wells in a water treatment plant --

23 Q That's right.

24 A -- is that right?

25 Q That's right.

1 A Okay. Let's clarify that.

2 Q Okay. So --

3 A So what is your question?

4 Q So TechFlowMP does not model, like,  
5 mixing of wells in a water treatment plant?

6 A No, it does not.

7 Q All right. Other than at Camp Lejeune,  
8 have you done any other projects where what MESL was  
9 doing was using TechFlowMP coupled with something to  
10 model mixing in a water treatment plant?

11 A Not a water treatment plant.

12 Q Was it used in conjunction with something  
13 other than a water treatment plant?

14 A Yeah. We -- we used it in an  
15 application, like how to treat contaminated sites.

16 Q Like a remediation project?

17 A Yeah. As a remediation project.

18 Q Okay. And am I correct that you have not  
19 tested --

20 A Please speak louder.

21 Q I'm sorry.

22 Am I correct that you have not testified  
23 or been deposed in the last four years?

24 A That's correct.

25 Q Have you ever been deposed before?

1 A No.

2 Q Have you ever testified at a trial?

3 A Can you speak louder, please?

4 Q I'm sorry.

5 MS. BAUGHMAN: You are not speaking  
6 louder. You keep speak --

7 MS. O'LEARY: Yeah.

8 THE WITNESS: You have a very --

9 MS. O'LEARY: Well --

10 THE WITNESS: -- soft voice.

11 MS. BAUGHMAN: He can't hear you.

12 MS. O'LEARY: So can you hear me,  
13 ma'am?

14 THE VIDEOGRAPHER: I can --

15 MS. O'LEARY: Can you hear me, Mr.  
16 Court Reporter?

17 COURT REPORTER: Sorry?

18 MS. O'LEARY: Can you hear me?

19 COURT REPORTER: Sure.

20 MS. O'LEARY: I'll try and speak  
21 louder but it seems that my voice is  
22 coming through.

23 MR. DEAN: Because you have a --

24 MS. BAUGHMAN: He doesn't have the  
25 same hearing level, okay? He's retired.

1 MS. O'LEARY: Yeah.

2 MS. BAUGHMAN: You need to speak  
3 louder.

4 BY MS. O'LEARY:

5 Q So have you ever testified in a trial?

6 A No.

7 Q Have you ever testified in any other  
8 setting?

9 A Not a setting like this.

10 Q Like a --

11 A Not --

12 Q -- a deposition?

13 A -- not --

14 Like a deposition, no.

15 Q Have you testified in some setting that's  
16 different than this?

17 A Yeah. We had a face-to-face dialogue  
18 with a opposing expert and me on the other side.

19 Q In what case are you talking about?

20 A I'm talking about Atlanta Gas Light  
21 pollution problem.

22 Q Okay. And when was that face-to-face?

23 A I don't recall exactly but it must be  
24 late 1990s.

25 Q And were you an expert for one of the



1 sides in that Atlan- -- Atlanta Gas Light pollution  
2 problem?

3 A I was one of the experts on the other  
4 side of the Atlanta Gas Light pollution problem  
5 or --

6 Q Who is on the other side? I'm not sure  
7 what you mean.

8 A Some law firm hired me to question the  
9 work done at the Atlanta Gas Light site.

10 Q Okay. And then you had a sitdown with  
11 the expert from the --

12 A Right.

13 Q -- Atlanta Gas Light site?

14 A Exactly.

15 Q Okay. Other than that Atlanta Gas Light  
16 site, have you ever served as an expert before for  
17 some sort of dispute?

18 A Not for a dispute but I served for  
19 expert -- as an expert in other studies.

20 Q What does it mean to serve as an expert  
21 in other studies?

22 A A consulting company comes and asks me as  
23 to what I think about this and that related to  
24 environmental pollution. It doesn't have to be  
25 groundwater. I offer my opinion --

1 Q Uh-huh.

2 A -- and that's a expert opinion.

3 Q Okay. And when was the last time you did  
4 that sort of consulting?

5 A Probably it was my work with Geosyntec.  
6 I don't recall the time, it's in my résumé.

7 Q And you said Geosyntec?

8 A Yeah, Geosyntec.

9 Q All right. Do you have any family  
10 members who filed claims under the Camp Lejeune  
11 Justice Act?

12 A No.

13 Q And do you have any acquaintances who  
14 have filed claims under the Camp Lejeune Justice  
15 Act?

16 A No.

17 Q Huh. And you can turn back to the same  
18 exhibit, so this is Government Exhibit 2, to page  
19 49.

20 A Yes.

21 Q And in the last paragraph, so near the  
22 bottom of the page --

23 MR. DEAN: What page are you on?

24 MS. O'LEARY: Forty-nine.

25

1 BY MS. O'LEARY:

2 Q The last paragraph, do you see where it  
3 says, "It is important to note that the review  
4 comments I am providing below are only associated  
5 with the water-modeling aspects of the ATSDR health  
6 study and the NRC report and do not cover any  
7 epidemiologic study aspects since those topics are  
8 outside my ar- -- expertise areas."

9 Did I read that correctly?

10 A Yes.

11 Q Is that accurate that epidemiologic  
12 studies are outside your expertise areas?

13 A That's correct.

14 Q Does it follow that the level of detail  
15 on exposure data needed for an epidemiological case  
16 control study is not within your area of expertise?

17 MR. DEAN: Object to the form.

18 A Yes. I -- I don't know what they would  
19 need.

20 BY MS. O'LEARY:

21 Q Okay.

22 A I'm told what I should do, so I do it.

23 Q And is it accurate then that the level of  
24 detail on contaminant exposure to an individual  
25 needed to render an opinion on causation from

1 contaminant exposure is not within your area of  
2 expertise?

3 A It's not. It's not within my area.

4 Q Okay. And do you agree that you are not  
5 an expert on whether a contaminant can cause a  
6 disease?

7 A I think you have to clarify that  
8 question.

9 Q Is that something that you render -- have  
10 ever, like, done consulting opinions on, on whether  
11 a contaminant can cause a disease?

12 A No, I did not.

13 Q And is that something that your  
14 university training study was -- was whether  
15 contaminants can cause a disease?

16 A That's a generic question,  
17 "contaminants." I'm not going to respond to that.

18 Q Well, do you study whether certain  
19 chemical compounds cause diseases?

20 A All foreign environmental contaminants  
21 will have some adverse effects on human health.

22 Q And how do you know that?

23 A Well, that's -- in terms of the  
24 literature that I have reviewed, in terms of the  
25 research work that I have done, that information was

1 made available to me.

2 Q So that's something you know from reading  
3 literature?

4 A That's right.

5 Q Okay. Have you ever studied  
6 epidemiology?

7 A No.

8 Q Your report, Government Exhibit 2,  
9 discusses maximum contaminant levels or MCLs. Do  
10 you know what I'm talking about?

11 A Yeah.

12 Q And do you understand that maximum  
13 contaminant levels are set by the Environmental  
14 Protection Agency, the EPA?

15 A That's correct.

16 Q Have you ever been involved in the  
17 setting of an MCL?

18 A No.

19 Q Are you familiar with the methodology  
20 that the EPA uses to establish MCLs?

21 A No.

22 Q Are you familiar with how MCLs are  
23 related to health risk?

24 A No.

25 Q Why did you discuss MCLs in your report

1 in this litigation?

2 A Because that was the criteria set by  
3 ATSDR.

4 Q So ATSDR asked you to consider MCL levels  
5 in the water modeling?

6 A I didn't consider MCL levels. I just  
7 predicted a continuous contaminant transport.  
8 Whether it's higher or lower, that was decided by  
9 ATSDR, right?

10 Q Higher or lower than --

11 A MCL.

12 Q -- like an MCL?

13 Okay.

14 A Right.

15 Q I understand, I think.

16 And am I correct that for your work on  
17 the Camp Lejeune Justice Act, you've been paid \$600  
18 per hour?

19 A That's correct.

20 Q How many hours, approximately, have you  
21 worked on the Camp Lejeune Justice Act litigation?

22 A I have to check my billing.

23 Q Do you think it's more than 50?

24 MR. DEAN: Object to the form.

25 You have the invoices.

1 BY MS. O'LEARY:

2 Q Do you think it's more than 50 hours?

3 A Probably. I don't --

4 Q Okay.

5 A -- recall.

6 Q Do you think it's more than a hundred  
7 hours?

8 MR. DEAN: Object to the form.

9 A I don't recall.

10 BY MS. O'LEARY:

11 Q You don't recall? Okay.

12 Do you know -- sorry.

13 Have you received any compensation  
14 related to the Camp Lejeune Justice Act other than  
15 your work as an expert witness?

16 A From?

17 Q Well, from any source? So other than  
18 your work as an expert witness.

19 A A -- A -- ATSDR funded the corporate  
20 agreement --

21 Q And --

22 A -- but I didn't get personal income from  
23 that, Georgia Tech did.

24 Q So when you were working at MESL on Camp  
25 Lejeune, was your salary paid by Georgia Tech?

1           A       Repeat that, please?

2           Q       When you were working on Camp Lejeune  
3       water modeling --

4           A       Right.

5           Q       -- at MESL --

6           A       Right.

7           Q       -- was your salary paid by Georgia Tech?

8           A       My salary was, of course, paid by Georgia  
9       Tech.

10          Q       Did the ATSDR fund MESL's work on Camp  
11       Lejeune?

12          A       That's correct.

13          Q       Okay. Are you familiar with a -- a text  
14       by Dougherty (phonetic) from 2015?

15          A       Which text?

16          Q       The one from 2015?

17          A       I'm sure he has written many texts.

18          Q       Okay. Is Dor- -- does Dougherty have a  
19       good reputation in the fields you work in?

20                   MR. DEAN: Object to the form of the  
21       question.

22          A       I don't recall who Dougherty is.  
23                   Does he have a first name?

24       BY MS. O'LEARY:

25          Q       Are you familiar with Panko and Cherry



1 (phonetic)?

2 A Yeah.

3 Q All right. Their 1996 text, is it  
4 considered a reliable authority in your field?

5 A As good as any other reference textbooks.

6 Q Okay. So I have some -- a few questions  
7 about the extent of your involvement in the ATSDR's  
8 water modeling.

9 A Right.

10 Q But I just wanted to see, would you like  
11 to take a break or are you okay to keep going?

12 A I'm okay.

13 Q All right.

14 MS. O'LEARY: So if we could get --  
15 that would be 56.

16 So this will end up being Government  
17 Exhibit 3.

18 (Whereupon, Government's Exhibit Aral  
19 3, Tarawa Terrace Chapter A Report,  
20 was marked for identification.)

21 BY MS. O'LEARY:

22 Q And Professor Aral, if you could go to  
23 the page that's numbered A6 in the -- it will be in  
24 the bottom left?

25 All right. Do you see a table that says,

1 "Table A2, Summary of ATSDR Chapter Reports" --

2 A Uh-huh.

3 Q -- at the top?

4 Okay. And am I understanding correctly  
5 that table A2 lists the chapter reports from the  
6 ATSDR water modeling on Tarawa Terrace?

7 A Yeah. These are the --

8 Q Okay. And --

9 A -- reports, yeah.

10 Q -- as I look at this table, it looks like  
11 you authored -- you are an author on chapter A,  
12 "Summary of Findings"; chapter G, "Simulation of  
13 Three-dimensional Multispecies Multiphase Mass  
14 Transport of Tetrachlorethylene and Associated  
15 Degradation Byproducts"; chapter H, on "The Effect  
16 of Groundwater Pumping Schedule Variation on Arrival  
17 of Tetrachlorethylene at Water Supply Wells at the  
18 Water Treatment Plant"; chapter I, "Parameter  
19 Sensitivity Uncertainty and Variability Associated  
20 with Model Simulations of Groundwater Flow  
21 Contaminant Fate and Transport" --

22 (Whereupon, the court reporter  
23 requests clarification.)

24 BY MS. O'LEARY:

25 Q -- "and Distribution of Drinking water."

1                   And then Chapter K, "Supplemental  
2                   Information."

3                   Is that correct that those are the only  
4                   chapters you authored on the ATSDR reports?

5           A        I didn't author, I contributed to them.

6           Q        Okay. So I see on table A2, that you are  
7                   listed as an author for those ones. What is the  
8                   difference to you between contributing to a report  
9                   and being an author?

10          A        There are several other names, probably.  
11                   The names that I see, for example, in G --

12          Q        Uh-huh.

13          A        -- it's a -- a graduate student of mine  
14                   and me.

15          Q        All right. So you both --

16          A        So we --

17          Q        -- wrote that?

18          A        -- we both contributed to that.

19          Q        Okay. And what role if any did you have  
20                   in writing or reviewing the other chapters from  
21                   table A2 where you are not listed as an author?

22          A        Probably I have looked at them,  
23                   reviewed --

24          Q        What do you mean, you looked at them?

25          A        Reviewed them.

1 Q And reviewed them for what purpose?

2 A For my understanding of what they are  
3 doing.

4 Q Okay. Did you offer comments on chapters  
5 you did not author -- you are not listed as an  
6 author on this table?

7 A I don't recall but I could have.

8 Q Okay. And --

9 MR. DEAN: For correction of the  
10 record, chapter K was never issued or  
11 published.

12 BY MS. O'LEARY:

13 Q So Professor Aral, what was Morris  
14 Maslia's role in the Tarawa Terrace water modeling  
15 project for ATSDR?

16 A He was the lead person at exposure of  
17 those reconstruction -- reconstruction program at  
18 ATSDR.

19 Q Okay. And were you happy with the  
20 performance of the team working on the Tarawa  
21 Terrace modeling at ATSDR?

22 A Yes.

23 MR. DEAN: Object to the form.

24 A Yes.

25

1 BY MS. O'LEARY:

2 Q And did you have any role on chapter J,  
3 "Field Test Data Analysis and Simulation of the  
4 Distribution of Drinking Water"?

5 A I think that's the least contribution  
6 that I had in any of these reports.

7 Q Was chapter J?

8 A Yeah.

9 Q Were you involved in data collection for  
10 the Tarawa Terrace water modeling?

11 A No.

12 Q Okay. Why were you not involved?

13 A Because they didn't ask me. I didn't go  
14 to the site, that's why.

15 Q Were you involved in field test design?

16 A No.

17 Q And have you been to Camp Lejeune?

18 A No.

19 Q And just one question about chapter K  
20 that Mr. Dean brought up.

21 Do you consider that chapter finished?

22 MR. DEAN: Object to the form of the  
23 question.

24 The chapter was never issued.

25 A I -- I don't recall that chapter at all.

1 MS. O'LEARY: Okay. And you can set  
2 aside Exhibit 3 for a moment and we are  
3 going to pull out -- this is 42.

4 That will be exhibit -- Government  
5 Exhibit 4.

6 (Whereupon, Government's Exhibit Aral  
7 4, Document, was marked for  
8 identification.)

9 THE WITNESS: Uh-huh.

10 BY MS. O'LEARY:

11 Q And Professor Aral, if you could go to  
12 page A4?

13 A Eighty-four?

14 Q A4.

15 MR. DEAN: A4.

16 A A4?

17 BY MS. O'LEARY:

18 Q "A," as in chapter A.

19 A Yes.

20 Q All right. Do you see, starting on A4  
21 and going onto page A5, table A1, summary of ATSDR  
22 chapter reports and supplemental information  
23 sections for the Hadnot Point-Holcomb Boulevard  
24 study area?

25 A Yup.

1           Q       Okay. And looking at this table, it  
2       seems to show that you -- you are listed as an  
3       author for chapter A, "Summary and Findings";  
4       sup- -- I guess it's chapter A, supplement two,  
5       "Development and application of a methodology to  
6       characterize present day and historical water supply  
7       well operations"; supplement five, "The theory,  
8       development, and application of Linear Control Model  
9       Methodology to Reconstruct Historical Contaminant  
10      Concentrations at Selected Water Supply Wells";  
11      supplement seven, "Source characterization and  
12      simulation of the migration of light nonaqueous  
13      phase liquids in the vicinity of the Hadnot Point  
14      industrial area"; and supplement eight, "Field test  
15      data analysis and simulation of the distribution of  
16      drinking water with emphasis on intermittent  
17      transfers of drinking water between the Hadnot Point  
18      and Holcomb Boulevard water distribution sys- --"

19                   Is that correct that those are the --

20                               (Whereupon, the court reporter  
21                               requests clarification.)

22      BY MS. O'LEARY:

23           Q       Holcomb Boulevard water distribution.

24                   Is that correct, Professor Aral, that  
25      those are the only chapters where you were listed as

1 an author?

2 A Yeah.

3 Q And similarly, did you contribute to  
4 those or did you author the whole thing?

5 A No, I contributed to them.

6 Q Okay. And in supplement eight, what  
7 field tests were involved in that?

8 A The field tests probably refers to the  
9 field studies that ATSDR has done on Camp Lejeune.  
10 I'm not involved in that. However, intermittent  
11 transfers of drinking water between the Hadnot Point  
12 and Holcomb Boulevard water distribution system is  
13 the part that I have contributed.

14 Q Okay. And were you involved in  
15 collecting historical data about the water  
16 distribution systems at Hadnot Point and Holcomb  
17 Boulevard?

18 A No.

19 MR. DEAN: Object to the form.

20 A No.

21 BY MS. O'LEARY:

22 Q Did you personally review historical  
23 documentation about the operations of the Hadnot  
24 Point/Holcomb Boulevard water distribution system?

25 A The intermittent transfer issue or the



1 operation of the water treatment plant?

2 Q Let me break that down farther.

3 A Okay.

4 Q So were you involved in reviewing  
5 historical documentation about intermittent  
6 transfers between the Hadnot Point area and Holcomb  
7 Boulevard areas?

8 A I have reviewed the data that was  
9 collected at the --

10 Q Okay.

11 A -- site.

12 Q Did you review data collected at the site  
13 other than for those intermittent transfers?

14 A Yes.

15 Q Okay.

16 A Several of them. Yeah.

17 Q And what sorts of things did you review  
18 other than for the intermittent transfers?

19 A Water treatment plant data --

20 Q Uh-huh.

21 A -- groundwater levels data, pumping data  
22 of supply wells --

23 Q Uh-huh.

24 A -- data collected from observation wells,  
25 any other data that was given to me in terms of

1 doing what we did at Georgia Tech.

2 Q Were --

3 A Yeah.

4 Q Thank you. I think I understand.

5 Were you personally involved in

6 collecting that data --

7 A No.

8 Q -- that you reviewed?

9 A No.

10 Q Okay. Okay.

11 Thank you. You can set aside that

12 exhibit --

13 A Uh-huh.

14 Q -- for now. And a few more questions  
15 about your role in the water modeling with ATSDR.

16 First about some of the people you worked  
17 with. So starting with Morris Maslia --

18 A Yes.

19 Q -- how long have you known Morris Maslia?

20 A I think he was a graduate student at  
21 Georgia Tech.

22 Q How many projects have you worked on  
23 together over the years?

24 A I worked as a consultant at Geosyntec. I  
25 think he was working at Geosyntec at that time, as

1 well.

2 Q Were there any other things besides the  
3 Geosyntec work?

4 A Other than conclusion, I don't recall.

5 Q Okay. Do you consider Morris Maslia a  
6 friend?

7 A Yes, of course.

8 Q Do your families know each other?

9 A No.

10 Q When's the last time you spoke to Morris  
11 Maslia about anything other than the Camp Lejeune  
12 Justice litigation?

13 A We had dinner several years ago in  
14 Atlanta.

15 Q Okay. Was that dinner before or after  
16 you'd been retained as an expert in the Camp Lejeune  
17 Justice Act litigation?

18 A I don't recall, honestly.

19 Q Have you ever served as a reviewer on any  
20 journals or a member of any committees that gave an  
21 award to Morris Maslia for his work?

22 A No.

23 Q Were you ever a reviewer on the American  
24 Society of Civil Engineers Water Planning and  
25 Management?

1 A Probably.

2 Q Okay. And --

3 A I have been a reviewer for many journals.

4 Q Okay. Which journals have you been a  
5 reviewer for?

6 MR. DEAN: Object to the form.

7 A It's in my résumé. It's about two pages  
8 long.

9 BY MS. O'LEARY:

10 Q Okay. Were you a reviewer of the ASCE  
11 Journal of Water Resources and Management in 2000?

12 A I could have been.

13 Q Were you a reviewer of the ASCE Journal  
14 of Water Resources and Management when they  
15 published a study about the ATSDR's modeling work  
16 on Dover Township --

17 A Not on that --

18 Q -- Toms River?

19 A Not on that study.

20 Q What do you mean, "not on that study"?

21 A I mean, that wasn't submitted for my  
22 review.

23 Q Ah. You mean you didn't review that --

24 A No.

25 Q -- study?

1 But you were a reviewer on the ASCE  
2 Journal of Water Resources and Management at the  
3 same time?

4 A Yeah. If they send me a paper to review,  
5 I do that.

6 Q Okay. Were you the editor in chief of  
7 the journal, Water Quality, Exposure and Health in  
8 2009, when it published a study about the ATSDR's  
9 work on the Tarawa Terrace modeling?

10 A That's correct.

11 Q Were you a reviewer of the journal,  
12 Water, in 2016 when they published a study about the  
13 ATSDR's work on the Hadnot  
14 Point/Holcomb Boulevard --

15 A No.

16 Q -- area model?

17 A No.

18 Q And were you Morris Maslia's professor  
19 when he was getting a master's degree at Georgia  
20 Tech?

21 A Yeah, I think I was. Yeah.

22 Q Would you consider yourself Morris  
23 Maslia's mentor when he was getting that master --

24 A Can you --

25 Q -- degree?

1           A       -- speak louder, please?

2           Q       Sure.

3                    Would you consider yourself as having  
4       been Morris Maslia's mentor when he was getting his  
5       master's degree?

6           A       Yes.

7                    MS. O'LEARY: We had -- this will be  
8       number nine and will be Government  
9       Exhibit 5.

10                   (Whereupon, Government's Exhibit Aral  
11                   5, Document Regarding Development of  
12                   Environmental Management Models, was  
13                   marked for identification.)

14                   (Whereupon, there was a discussion  
15                   off the record.)

16                   MR. DEAN: Dr. Aral, if you have any  
17                   difficulty whatsoever hearing the  
18                   question, don't hesitate to tell her  
19                   she's talking too softly --

20                   THE WITNESS: Okay.

21                   MR. DEAN: -- to confirm. I know  
22                   it's kind of repetitive, but do it  
23                   anyway.

24                   THE WITNESS: Okay.

25

1 BY MS. O'LEARY:

2 Q So Professor Aral, I've handed you what's  
3 been marked as Government Exhibit 5.

4 Do you recognize this document?

5 A Yes, I do.

6 Q What is this?

7 A It just talks about the development of  
8 environmental management models over the years.

9 Q Okay.

10 A And I'm trying to explain how it evolved  
11 into the present day analysis.

12 Q And did you author this?

13 A I see my name on it.

14 Q But do you recall authoring this?

15 A Yes, of course.

16 Q Okay.

17 MS. O'LEARY: And if we could take a  
18 break for about five minutes, I need  
19 to...

20 THE WITNESS: Okay.

21 MS. O'LEARY: Just a minute.

22 THE VIDEOGRAPHER: The time right  
23 now is 10 a.m. We are off the record.

24 (Whereupon, there was a recess taken  
25 from 10:00 a.m. to 10:09 a.m.)

1 THE VIDEOGRAPHER: The time right  
2 now is 10:10 a.m. We are back on the  
3 record.

4 MS. O'LEARY: All right. Thank you.

5 BY MS. O'LEARY:

6 Q And Professor Aral, just to remind you,  
7 you remain under oath.

8 Do you understand?

9 A Okay.

10 Q Okay. So we are going to set aside that  
11 exhibit and I'm going to hand you a different one.

12 MS. O'LEARY: This will be  
13 Government Exhibit 6.

14 (Whereupon, Government's Exhibit Aral  
15 6, Environmental Modeling and Health  
16 Risk Analysis, by Mustafa M. Aral,  
17 was marked for identification.)

18 BY MS. O'LEARY:

19 Q Professor Aral, the front page of this  
20 says, Environmental Modeling and Health Risk  
21 Analysis (Acts/Risk), and it has your name, "Mustafa  
22 M. Aral."

23 Do you know what Environmental Modeling  
24 and Health Risk Analysis (Acts/Risk) is?

25 A Yes.



1 Q What is it?

2 A Environmental modeling is a procedural  
3 analysis of environment using models. Health risk  
4 analysis is another procedural use of health risk  
5 effects --

6 Q Okay.

7 A -- of environmental contaminants.

8 Q And if -- as you look through Government  
9 Exhibit 6, does this looks like excerpts from a  
10 textbook that you authored?

11 MR. DEAN: Object to the form of the  
12 question.

13 You used the term "excerpts." I'm  
14 just pointing out this is not the whole  
15 text, it goes to page 16.

16 A Yes, it looks like parts of it. Yeah.

17 BY MS. O'LEARY:

18 Q And did you author a textbook called  
19 Environmental Modeling and Health Risk Analysis?

20 A Yes. It has my name on it.

21 Q And if you could go on Government Exhibit  
22 6 to the page -- it should say 17?

23 A Uh-huh.

24 Q Okay. In the bottom paragraph on page  
25 17, could you read that paragraph, Professor Aral?

1           A           "On the other hand, there are at least  
2     three reservations one should always bear in mind  
3     while constructing and using a model (Rubinstein --  
4     Rubinstein 1981). First, there's no guarantee that  
5     the time and effort devoted to modeling will return  
6     useful results and satisfactory benefits.  
7     Occasional failures are expected to occur because of  
8     limited resources allocated to modeling. More  
9     often, however, failure results when the  
10    investigators relies too much on the method and not  
11    on the ingenuity and construct of the --  
12    construction -- constructing the model. The proper  
13    balance between the two is the key to success in  
14    modeling.

15                   "The second reservation concerns the  
16    tendency of the investigator to treat his or her  
17    mathematical description of the problem as the best  
18    representation of the reality. One should be open  
19    minded in understanding the limitations of the  
20    proposed model."

21                   "The third reservation concerns the use  
22    of model outside the predictive range of the model  
23    developed. When working with a model, care must be  
24    given to ensure that the analysis remains within the  
25    valid representation range of the model. These are

1 important concepts of concern when working with a  
2 model -- with models."

3 Q And Professor Aral, did you write that  
4 paragraph that you just read?

5 A Yeah.

6 Q Do you --

7 A Yes.

8 Q -- agree with it still?

9 A Yes.

10 Q Okay. When it said "the use of the model  
11 outside the predictive range of the model developed  
12 is a reservation in modeling," why is that?

13 So why is it that the use of the model  
14 outside the predictive range of the model  
15 development should be considered?

16 A Okay.

17 MR. DEAN: Object to form.

18 A When someone develops a model, it  
19 involves some approximation of the environment. If  
20 the construct of the model does not include all the  
21 important aspects of the modeling aspects of the  
22 environment, then some of the processes that exist  
23 in the environment may not -- may not be represented  
24 in the model. That's a problem. That's what I'm  
25 referring to there.

1 BY MS. O'LEARY:

2 Q Okay. And in that paragraph when it  
3 refers to the predictive range of the model, what is  
4 the predictive range of the model?

5 MR. DEAN: Object to the form.

6 A Predictive range is what I have  
7 described. For example -- just to give you an  
8 example, if you are working with surface water  
9 models, if you exclude advective transport and use  
10 only diffusive transport, than the predictive range  
11 is defined wrong.

12 The main transport parameter in a surface  
13 water model is the advective range. So if you -- if  
14 your model construct is wrong, its predictive range  
15 is limited.

16 BY MS. O'LEARY:

17 Q Okay. How do you determine the  
18 predictive range of a model?

19 A You have to understand what's going on in  
20 the environment as the major contributors to what  
21 you are trying to model.

22 Q Okay. And what does it mean to have the  
23 valid representation range of the model?

24 A As I have explained a minute ago, all the  
25 dominant characteristics of the environment should

1 be represented for the model to be successful.

2 Q How do you determine what the dominant  
3 characteristics are?

4 A You have to understand the environmental  
5 processes that you are modeling.

6 Q And how do you determine which  
7 environmental processes you are modeling?

8 A You have to understand the environmental  
9 processes that you are working with.

10 Q Okay. How -- with that understanding of  
11 the environmental processes you are working with,  
12 how do you determine what representation range would  
13 be valid for a model of those processes?

14 A As I have said a minute ago, if you  
15 exclude the dominant processes from a model, it will  
16 not be a successful model.

17 As I have described in surface water  
18 modeling, if you ignore advective transport and only  
19 include diffusive transport, that's not going to be  
20 a successful model.

21 Q Staying on the same exhibit, could you go  
22 to page 18, which is the next page?

23 A Page what?

24 MR. DEAN: Eighteen.

25

1 BY MS. O'LEARY:

2 Q Page 18, just the next page?

3 A Okay.

4 Q And the bottom paragraph on page 18 that  
5 starts, "Model accuracy and reliability," do you see  
6 that?

7 A Yes.

8 Q Could you read that paragraph, please?

9 A "Model accuracy and reliability are two  
10 of the more important aspects of modeling which  
11 should not be overlooked if a model is to be  
12 accepted as a reliable predictive tool numerical  
13 error bounds generated in computation should be  
14 within acceptable limits and the model should be  
15 calibrated regionally or locally using available  
16 data. Proceeding in the -- in this direction much  
17 of the recent work done in environmental quality  
18 modeling has been -- has been oriented towards  
19 improving models and incorporating better numerical  
20 solution techniques, the accuracy of which by far  
21 surpasses the availability and accuracy of the field  
22 parameter data that have to be used with such  
23 models. Scarcity of the field data, especially in  
24 air, groundwater, surface water quality modeling is  
25 well known to researchers and engineers working in

1     this field.

2                 "Currently, there is some disagreement  
3     among researchers as to whether higher priority  
4     should be placed on still further developments and  
5     model sophistication or on parameter prediction to  
6     improve accuracy."

7             Q         And do you agree with this paragraph  
8     still today?

9             A         What does it say?

10            Q         Do you agree with --

11            A         Oh, yeah.

12            Q         -- what it says today?

13            A         Yes, I do.

14            Q         Okay. And how do you determine  
15     acceptable limits for numerical error bounds?

16                         MR. DEAN: Object to the form.

17            A         Well, I'm trying to say in here is that  
18     as the computers or the field of computer  
19     applications advanced, we are using more, faster,  
20     and higher precision computers. Using that base, we  
21     are able to come up with more sophisticated  
22     numerical algorithms to predict the behavior of a --  
23     or calculate the behavior of a model in a more  
24     precise manner.

25                         What I am trying to say here is that

1     there should be a balance between computational  
2     aspects as opposed to model construct.

3     BY MS. O'LEARY:

4             Q       And when you say a balance, a balance  
5     in what?   In terms of sophistication or something  
6     else?

7             A       The balance is in reference to how we  
8     represent the environment, computational aspects  
9     refers to how we compute the mathematics of the  
10    algorithms that we have proposed.

11            Q       Okay.   And what does it mean to calibrate  
12    a model regionally?

13            A       Well, you use the data available at the  
14    site and either manually or statistically try to  
15    adjust some of the parameters of the model that you  
16    have developed to match the observed database that  
17    you have at the site.   And that's the standard  
18    calibration process.

19            Q       And why -- why should you use available  
20    data from the site as opposed to, like, a literature  
21    reference?

22            A       Well, both can be used.

23            Q       Okay.   So in -- in page 18, it -- it says  
24    using field parameter data.

25            A       Yeah.



1 Q Is that right?

2 A Yeah.

3 Q Why -- why reference field parameter  
4 data?

5 A Because we are trying to fee- --  
6 represent some environment at the field. We have --  
7 if you are developing a model for that field, we  
8 would like to use field parameters.

9 Q Okay. What does it mean to calibrate a  
10 model locally?

11 A Oh, this -- this is a matter of  
12 dimensions. You can calibrate a regional aquifer,  
13 like Floridan aquifer, which includes the aquifer  
14 system in Georgia and Florida --

15 Q Okay.

16 A -- as USGS is doing or I would call a  
17 local analysis, like Camp Lejeune application, which  
18 is relatively small in reference to a Floridan  
19 aquifer.

20 Q Okay. And similarly to regional  
21 calibration, why would you use --

22 A Can you speak, please, louder?

23 Q Yes.

24 So why would you use available field data  
25 for calibrating a model locally?

1           A       For the same reason as we would use a  
2 regional model -- to calibrate a regional model.

3           Q       Okay. Staying on this same exhibit, if  
4 you can be on page 19, so where the --

5           A       Uh-huh.

6           Q       -- last paragraph ended, can you read the  
7 next paragraph that starts, "A very simplistic  
8 model"?

9           A       The whole paragraph I should read?

10          Q       No. Actually, just -- I'll -- I'll -- do  
11 you mind if I just stop you when I need you to stop?

12          A       Okay.

13          Q       Okay. Go ahead.

14                 So if you could start reading and I'll  
15 just ask you to stop.

16          A       I see. Okay.

17                 "A very simplistic model may use a very  
18 crude -- crude definition of a physical process with  
19 few parameters to define the process. A very  
20 complex model may use a very detailed definition of  
21 a physical process, which is a significant increase  
22 in -- with a significant increase in parameters that  
23 is used to define the process.

24                 "Naturally, improved sophistication of  
25 the models is associated with the increase and the

1 number of model parameters. Since it's likely that  
2 many of the additional parameters included in the  
3 model will be defined only in qualitative terms or  
4 with lesser accuracy, a relatively more  
5 sophisticated model can be less reliable than the  
6 simpler version. On the other hand, some systems  
7 and some physical phenomenon are so complex in  
8 nature that it's often little reason to believe that  
9 good simulations are possible with simplified  
10 representations."

11 Q And you can stop there --

12 A Okay.

13 Q -- Professor Aral. Thank you.

14 And do you agree with the portion of that  
15 paragraph you've just read?

16 A Yes.

17 Q And how would parameters defined only in  
18 qualitative terms or with lesser accuracy lead to a  
19 less-reliable sophisticated model relative to a  
20 simpler one?

21 MR. DEAN: Object to the form of the  
22 question.

23 A Can you repeat that so that I can  
24 understand what you are --

25

1 BY MS. O'LEARY:

2 Q Would you like me to rephrase?

3 A Yes. Rephrase, please.

4 Q So Professor Aral, the paragraph said  
5 that when parameters are defined only in qualitative  
6 terms or with lesser accuracy, this can lead to  
7 situations where a sophisticated model is less  
8 reliable than a simpler one.

9 Do you agree?

10 MR. DEAN: Object to the form of the  
11 question.

12 A Well --

13 MR. DEAN: It mischaracterizes --

14 THE WITNESS: Yeah.

15 MR. DEAN: -- misstates --

16 A I'm assuming here is that a complex model  
17 is going to need more database to implement the  
18 model. If we are talking about more database, some  
19 of those databases may not be available and can be  
20 only determined through some qualitative analysis of  
21 what we know about the database.

22 In that case, the -- the database being  
23 qualitative may result in model response not being  
24 as accurate as we would like to see.

25

1 BY MS. O'LEARY:

2 Q So in those situations where you don't  
3 have the databases for some parameters, is that  
4 where a simpler model could be more reliable than a  
5 sophisticated model?

6 MR. DEAN: Object to the form of the  
7 question.

8 A If there's no database available, yes,  
9 that would be a better idea.

10 BY MS. O'LEARY:

11 Q What if you had sophisticated models  
12 where you had some databases for parameters but very  
13 few, could that still lead to situations where the  
14 sophisticated model that needs that, you know, small  
15 bit of information available is less reliable than a  
16 simpler model?

17 MR. DEAN: Object to the form.

18 A No, I don't think so.

19 BY MS. O'LEARY:

20 Q Why not?

21 A Because a complex model can be used with  
22 partial databases available at the site. And then  
23 there are other databases, if needed, can be  
24 associated with the database that you are using,  
25 characterization of the site --

1 Q Uh-huh.

2 A -- and other information that you have at  
3 the site.

4 Q So that would allow you to run the  
5 sophisticated model --

6 A Yeah.

7 Q -- is that right?

8 A Yeah.

9 Q But how do you know it's more reliable  
10 than a less sophisticated model?

11 A Oh, it is reliable because we are  
12 representing the environment in a better form. In  
13 other words, as I said earlier, if you omit dominant  
14 features of an environmental process, your model  
15 will become simple but, at the same time, much more  
16 uncertain or inaccurate.

17 Q Okay. Another portion of what you read  
18 said that, "On the other hand, some systems and some  
19 physical phenomena are so complex in nature that  
20 there is often little reason to believe that good  
21 simulations are possible with simplified  
22 representations."

23 And my --

24 A Yeah.

25 Q -- question is: How do you determine

1 whether physical phenomena are so complex that good  
2 simulations are unlikely?

3 A Well, you have to have experience in the  
4 environmental analysis and modeling techniques.

5 Q But specifically, how would you approach  
6 those techniques to determine when physical  
7 phenomena are so complex that a good simulation --

8 A You should --

9 Q -- is unlikely?

10 A -- you need to have an education in that  
11 field to understand what you are doing and what you  
12 are doing properly.

13 Q And is there agreement in the field on  
14 when it is that physical phenomena are so complex  
15 that good simulations are unlikely?

16 A Mostly, yes.

17 Q You said "mostly."

18 Where is there --

19 A Some people --

20 Q -- remaining disagreement?

21 A -- may not understand the environmental  
22 processes properly so they may end up using simpler  
23 models. That will be a problem.

24 Q But I mean, you agree then there are some  
25 times when physical phenomena are so complex that a

1 good simulation is unlikely?

2 A Please --

3 MR. DEAN: Object to the form of the  
4 question.

5 A -- speak louder.

6 BY MS. O'LEARY:

7 Q Yeah.

8 This exhibit says that "physical  
9 phenomena can be so complex that good simulations  
10 are unlikely."

11 Do you agree?

12 MR. DEAN: Object to the --

13 MS. BAUGHMAN: Object to the --

14 A I don't understand the relevance of the  
15 question in reference to the Camp Lejeune modeling.

16 BY MS. O'LEARY:

17 Q So right now my question is just about  
18 what this textbook says.

19 A Okay.

20 Q So the -- where it says, "On the other  
21 hand, some systems and some physical phenomena are  
22 so complex in nature, that there is often little  
23 reason to believe that good simulations are possible  
24 with simplified representations," that section; do  
25 you agree that that's true?



1 A That's true.

2 Q Okay. And then I think we are going to  
3 jump forward on this exhibit.

4 A Uh-huh.

5 Q -- to -- there's a page 56.

6 (Whereupon, there was a discussion  
7 off the record.)

8 A Fifty-six. Oops.

9 Yeah. Okay.

10 BY MS. O'LEARY:

11 Q And there's a figure and then a paragraph  
12 below that, that starts, "The uncertainty and  
13 errors."

14 Do you see that?

15 A Yes.

16 Q Would you mind reading that paragraph,  
17 please?

18 A "The uncertainties and errors in  
19 simulation may arise from uncertainty in model  
20 inputs or parameters, i.e., parametric -- parametric  
21 or data uncertainty. When a model application  
22 involves both model and data uncertainties, it's  
23 important to identify the relative magnitudes of the  
24 uncertainties associated with the data and model  
25 formulation."

1 Q And you can -- sorry. Go ahead.

2 A "Such a comparison is useful for focusing  
3 resources where they are most appropriate, data gaps  
4 versus model refinement."

5 Q Thank you, Professor Aral.

6 And why is it important to identify the  
7 relative magnitudes of the uncertainties associated  
8 with data and model formulation?

9 A Because the model itself uses some  
10 database from some field and the effects of the  
11 uncertainty on the database need to be characterized  
12 through some analysis. That is what is uncertainty  
13 analysis is.

14 Q But why -- why do they need to be  
15 characterized?

16 A Because we would like to understand  
17 whether the model is behaving properly in reference  
18 to the uncertainty that exists at the database.

19 Q So does that make it important to the  
20 model's reliability?

21 A Model's -- model reliability is a  
22 different subject. Uncertainty analysis is a  
23 different subject.

24 Q Okay. I'm not sure I understand then  
25 what the uncertainty -- why identifying the relative

1 magnitude of uncertainties is important.

2 MR. DEAN: Object to the form of the  
3 question.

4 BY MS. O'LEARY:

5 Q Why --

6 MR. DEAN: You need to ask a  
7 question.

8 BY MS. O'LEARY:

9 Q Why is it that it's important to know the  
10 relative magnitude of uncertainties?

11 A Right. Because it refers to the  
12 uncertainty on the database. If there's uncertainty  
13 on the database, the model response will give us a  
14 range of error bounds.

15 Q Uh-huh.

16 A So the model's behavior can be  
17 characterized to see whether it's working in --  
18 within that model uncertainty band -- band that we  
19 have developed in terms of uncertainty analysis.

20 Q Okay. You can set aside that exhibit.  
21 Thank you.

22 MS. O'LEARY: And can we pull 23?  
23 (Whereupon, there was a discussion  
24 off the record.)  
25

1 BY MS. O'LEARY:

2 Q Actually, we will move on, actually, to  
3 some questions, more specifically, about the ATSDR  
4 water modeling at Tarawa Terrace.

5 A Okay.

6 Q So could you --

7 A Are we --

8 Q -- go back --

9 A -- skipping this?

10 Q We're skipping that one for right now,  
11 yeah.

12 A Okay.

13 Q Could you go back to -- could you go back  
14 to Exhibit 3, please, Government Exhibit 3?

15 It should be the -- I think it's in that  
16 stack, actually --

17 A Excuse me.

18 Q -- Professor Aral.

19 A It's --

20 Q Oh, it's there?

21 A Yeah.

22 Q Okay. Perfect. Thank you.

23 MR. DEAN: Can you tell me what  
24 Exhibit 3 was? Was it A -- chapter A  
25 or --

1 MS. O'LEARY: Chapter A for Tarawa  
2 Terrace.

3 MR. DEAN: Okay.

4 A Yes.

5 BY MS. O'LEARY:

6 Q Okay. So Professor Aral, can you go to  
7 one of the early pages on this report. This will be  
8 page iii, so little Roman numeral iii.

9 A Three. Yeah. Okay.  
10 Forward.

11 Q Yeah. It should say, "The Forward."  
12 And can you read the first paragraph,  
13 please?

14 A "The Agency for Toxic Substances and  
15 Disease Registry, ATSDR, an agency of the U.S.  
16 Department of Health and Human Services, is  
17 conducting an epidemiologic study to evaluate  
18 whether the -- whether in utero an infant up to one  
19 year of age exposure to volatile organic compounds  
20 in contaminated drinking water at U.S. Marine Corps  
21 Base Camp -- Base Camp Lejeune, North Carolina, were  
22 associated with specific birth defects and childhood  
23 cancers.

24 "The study includes births occurring  
25 during the period 1968 to 1985 to women who were

1 pregnant while they resided in family housing at the  
2 base. During 2004 -- or -- at the base.

3 "During 2004, the study protocol received  
4 approval from the Centers for Disease Control and  
5 Prevention Institutional Review Board and the U.S.  
6 Office of Management and Budget."

7 Q And -- so Professor Aral, when you were  
8 working on the Tarawa Terra- -- Terrace water  
9 modeling with the ATSDR, were you aware that the  
10 ATSDR was conducting an epidemiological study to  
11 evaluate whether in utero and infant exposures to  
12 VOCs in contaminated drinking water at Camp Lejeune  
13 were associated with childhood cancers?

14 A I heard that in expert panels and so  
15 forth.

16 Q And were you aware of the time frame of  
17 that study of 1968 to 1985?

18 A Yes, I'm aware of that.

19 Q Okay. And then the next paragraph says,  
20 "Historical exposure data needed for the  
21 epidemiological case control study are limited. To  
22 obtain estimates of historical exposure, ATSDR is  
23 using water modeling techniques and the process of  
24 historical reconstruction. These methods are used  
25 to quantify concentrations of particular

1 contaminants in finished water and to compute the  
2 level and duration of human exposure to contaminated  
3 drinking water."

4 Did I read that correctly?

5 A Yeah. That's correct.

6 Q When you were working on the Tarawa  
7 Terrace water modeling, were you aware that the  
8 modeling work you were doing was intended for this  
9 epidemiological study?

10 A Yes.

11 Q And were you aware that it was not  
12 intended for estimating an individual's exposure?

13 MR. DEAN: Object to the form of the  
14 question.

15 A I -- I am -- I don't have any idea on  
16 that --

17 BY MS. O'LEARY:

18 Q Okay.

19 A -- question.

20 Q When you were working on the Tarawa  
21 Terrace water modeling, were you aware that the  
22 modeling work you were doing was not intended to be  
23 used so that a particular individual could determine  
24 whether an estimated exposure from the model caused  
25 his or her health condition?

1           A           I can't --

2                       MR. DEAN: Object --

3           A           -- answer that.

4                       MR. DEAN: Let me -- let me object  
5                       to the form of the question, please.

6 BY MS. O'LEARY:

7           Q           Why can't you answer that?

8           A           Because that's a "epi" topic that I'm  
9           familiar with --

10                      (Whereupon, the court reporter  
11                      requests clarification.)

12          A           "Epi," epidemiologics.

13 BY MS. O'LEARY:

14          Q           So are you saying you don't know?

15          A           What it is going to be used for --

16          Q           You --

17          A           -- I don't know what the models are going  
18          to be used for. Is -- is it for a public exposure?  
19          Individual exposure? Community exposure? I have no  
20          idea.

21          Q           So when I look at page iii on this  
22          Exhibit, the Tarawa Terrace chapter A, it looks like  
23          it's saying the historical exposure data were needed  
24          for the epidemiological case control study.

25                       MR. DEAN: Object to the form.



1 BY MS. O'LEARY:

2 Q Am I understanding that correctly?

3 MR. DEAN: Object to the form of  
4 the question. Mischaracterizes --

5 A That's --

6 MR. DEAN: You are not reading the  
7 paragraph -- the paragrapher correctly.

8 A Well, that's what ATSDR, as a whole  
9 within different units, are going to investigate  
10 that, but that has nothing to do with what I'm  
11 doing.

12 BY MS. O'LEARY:

13 Q But you are listed as an author of  
14 chapter A; correct?

15 A I am not an author on the "epi" study. I  
16 am on the -- on the author -- I am the author on the  
17 modeling aspects of this. So this is probably a  
18 group of people doing different work, different  
19 fields and using each other's inputs, outputs.

20 Q Okay. Professor Aral, can we go to your  
21 report again?

22 A Yes.

23 Q And this is Exhibit 2, Government --

24 A Yeah.

25 Q -- Exhibit 2.

1           Give me just a minute while I try to find  
2   the page I want you to turn to.

3           All right. If you could go to pages four  
4   to five of your report?

5           A       My expert report?

6           Q       Of your report, yes.

7                   MR. DEAN: Uh-huh.

8           A       Yes.

9                   MR. DEAN: What page? I'm sorry.

10                  MS. O'LEARY: I had said four to  
11   five.

12                  MR. DEAN: Okay.

13                  MS. O'LEARY: But we may be moving.

14                  Oh, excuse me. Page 12.

15                  THE WITNESS: Okay.

16   BY MS. O'LEARY:

17           Q       And, Professor Aral, this is in a section  
18   called, "Principles of water modeling and  
19   application at Camp Lejeune," and subsection 4.1  
20   "Water Modeling."

21                  Do you see the sections?

22                  And then --

23           A       Yeah.

24           Q       Okay. There's a -- it says -- in the  
25   middle of the page, it says, "My opinions within a

1 reasonable degree of scientific and engineering  
2 certainty on modeling techniques, their principles  
3 and their application to the Camp Lejeune site  
4 include the following," and then there's a list  
5 of -- a bulleted list.

6 Do you see that?

7 A Yes.

8 Q Okay. So the second to the last bullet  
9 from the bottom says, "The models and techniques  
10 used by the ATSDR for historical reconstruction,  
11 including fundamental equations, input parameters,  
12 parameter estimates, calibration uncertainty and  
13 sensitivity analyses were and remain reliable,  
14 scientifically valid and state of the art procedures  
15 that are consistent with standard practices used and  
16 are generally accepted in this field."

17 Do you agree with that statement still?

18 A Yes.

19 Q Okay. And -- and then if you go onto  
20 page 13, the last bullet, do you see where I'm  
21 looking at?

22 A Yeah.

23 Q It says, "The analyses published in all  
24 ATSDR chapter reports, ATSDR 2007 and ATSDR 2013,  
25 and supplemental information regarding Camp Lejeune,

1 see figure two, including the conclusions and  
2 monthly concentration data, were all done applying  
3 proper scientific and engineering methodologies and  
4 remain to this day to be mathematically reliable,  
5 statistically, accurate and correct."

6 Did I read that properly?

7 A Yes.

8 Q Do you agree with that?

9 A Yes.

10 Q Okay. So if you are saying that the  
11 analyses -- analyses published in all ATSDR chapter  
12 reports and supplemental information on Camp Lejeune  
13 were done applying proper scientific and engineering  
14 methodologies and remain to this day to be  
15 mathematically reliable, statistically accurate and  
16 correct, then if we come back to my questions about  
17 the forward in the ATSDR chapter A report --

18 (Whereupon, the court reporter  
19 requests clarification.)

20 BY MS. O'LEARY:

21 Q Yes.

22 -- the chapter A report for Tarawa  
23 Terrace --

24 MS. BOLTON: Exhibit 3.

25 MS. O'LEARY: Yes, Exhibit 3.

1           A           Uh-huh.

2       BY MS. O'LEARY:

3           Q           -- I mean, aren't you saying that this  
4       isn't correct?

5                       MR. DEAN: Object to the form. I'm  
6       not sure what the question is.

7           A           As far as I understand the question, what  
8       I am referring to in my expert report refers to  
9       modeling aspects of the environment that we are  
10      trying to model, they are accurate, scientifically  
11      correct, mathematically correct, statistically  
12      correct.

13                      But this paragraph that you are referring  
14      to is associated with the use of these outcomes in  
15      "epi" studies. That is outside my expertise area.

16                      Probably ATSDR is correct in putting that  
17      paragraph in there but that's not my expertise area.  
18      Is -- I am only a contributor to this chapter, not  
19      the author of this chapter.

20       BY MS. O'LEARY:

21           Q           Okay. So the limit on your statement  
22      about the -- that we just read from your report --  
23      is -- is limited to the -- the modeling  
24      aspects of --

25           A           Exactly.

1 Q -- the ATSDR reports?

2 Okay.

3 A Exactly.

4 Q If you can stay in the chapter A report  
5 and go to page 90 -- A 98, is how it's labeled.

6 A A 90?

7 MR. DEAN: Ninety-eight.

8 BY MS. O'LEARY:

9 Q Ninety-eight.

10 A Ninety-eight.

11 Yes.

12 Q Okay. So Professor Aral, there are two  
13 columns; do you see that?

14 A Yeah.

15 Q The column on the left, the bottom  
16 question, it starts "ATSDR's historical  
17 reconstruction analysis."

18 Do you see that?

19 A Yeah.

20 Q All right. In the paragraph that's to  
21 the right of that, so in the other column, do you  
22 see where it says "ATSDR's exposure assessment  
23 cannot be used to determine whether you or your  
24 family suffered any health effects as a result of  
25 past exposure to PCE contaminated drinking water at

1     Camp Lejeune. The study will help determine if  
2     there is an association between certain birth  
3     detects and childhood cancers among children whose  
4     mothers used this water during pregnancy.  
5     Epidemiological studies such as this help improve  
6     scientific knowledge of the health effects of these  
7     chemicals."

8             Did I read that correctly?

9             A        Yes.

10            Q        Do you agree?

11            A        It's outside my expertise area.

12            Q        Okay. And staying in this same report  
13     but flipping back to page A67?

14            A        Yes.

15            Q        And there's a -- two columns. The one on  
16     the right says, "Summary and Conclusions."

17            A        Yeah.

18            Q        Do you see that column?

19            A        Yeah.

20            Q        The first paragraph there begins, "Two of  
21     the three drinking water systems that served family  
22     housing at U.S. Marine Base Camp Lejeune were  
23     groundwater with VOCs. Groundwater was the sole  
24     source of drinking water supply. One system, the  
25     Tarawa Terrace drinking water system, was mostly

1 contaminated with PCE when water supply wells were  
2 contaminated by off-base dry cleaning operations at  
3 ABC One-Hour Cleaners." And then it cites Shriver,  
4 1985.

5 Did I read that correctly?

6 A Yes.

7 Q Do you agree that the Tarawa Terrace  
8 drinking water system was mostly contaminated with  
9 PCE?

10 A That's -- that's correct.

11 Q And I apologize for jumping around within  
12 this exhibit --

13 A That's okay.

14 Q -- but can you go back to page A1,  
15 please, and going onto page A2, which is farther  
16 from the beginning than you might think. The Roman  
17 numerals go on for a little ways.

18 A Okay.

19 Q You should be on a page that says  
20 "Abstract," on the left.

21 Do you see that?

22 A A2?

23 Q A1, going --

24 A A1.

25 Q -- into A2.



1           A       Okay.

2                    Yes.

3           Q       Okay.  So the -- the column on the right,  
4   the last paragraph that starts, "Models and  
5   methods."

6                    Do you see that?

7           A       Yes.

8           Q       So it says, "Models and methods used as  
9   part of the historical reconstruction process for  
10  Tarawa Terrace and vicinity included one, MODFLOW-6  
11  used for simulating steady state, predevelopment,  
12  and transient groundwater flow; two, MT3DMS, used  
13  for simulating three-dimensional single-specie  
14  contaminant fate and transport; three, a materials  
15  mass balance model simple mixing used to compute the  
16  flow-weighted average concentration of PCE assigned  
17  to the finished water at the Tarawa Terrace Water  
18  Treatment Plant, WTP; four, TechFlowMP used for  
19  simulating three-dimensional multispecies,  
20  multiphase mass transport; five, PS Ops used for  
21  simulating the impacts of unknown and uncertain  
22  historical well operations; six, Monte Carlo  
23  simulation and sequential Gaussian simulation used  
24  to conduct probabilistic analyses to assess  
25  uncertainty and variability of concentrations of

1 PCE-contaminated groundwater and drinking water; and  
2 seven, EPANET 2, used to conduct extended period  
3 hydraulic and water quality simulations on the  
4 Tarawa Terrace water distribution system."

5 Did I read that correctly?

6 A Yes.

7 Q Am I understanding this correctly that  
8 the ATSDR -- that this is describing ATSDR's process  
9 for historical reconstruction of contaminants at  
10 Tarawa Terrace?

11 A I think it describes the models used in  
12 that process.

13 Q In that process, okay.

14 Oh, sure distinguished as from, like,  
15 data collection or --

16 A Yeah.

17 Q -- other aspects?

18 A Different aspects are different.

19 Q Yeah. Okay. I understand.

20 But in terms of the modeling, am I  
21 understanding correctly that at Tarawa Terrace,  
22 ATSDR's historical reconstruction process for  
23 modeling did not include simulating historical  
24 benzene concentrations at Tarawa Terrace?

25 A TechFlowMP can model PCE -- oh, this is

1 in reference to Tarawa Terrace, right?

2 Q Right.

3 A Okay.

4 Q At Tarawa Terrace.

5 A Right. Of course.

6 We didn't use -- we didn't analyze  
7 benzene at Tarawa Terrace.

8 Q Okay. And would you agree that in your  
9 report you have not offered opinions about simulated  
10 historical benzene concentrations at Tarawa Terrace?

11 A We did not simulate that.

12 Q And so you -- is that why you didn't  
13 offer any in your report?

14 A Well, can you repeat that question?

15 Q Yeah. Let me rephrase.

16 So your report in this litigation, it  
17 also does not offer opinions on historical benzene  
18 contamination levels at Tarawa Terrace.

19 A It --

20 Q Is that right?

21 A It -- we did not simulate benzene  
22 concentrations at Tarawa Terrace.

23 Q Okay. Staying in the Tarawa Terrace  
24 chapter A report, could you go to page A17, please?

25 A Okay.

1           Q       And in the column on the left, there's a  
2       label in the middle that says, "Relation of  
3       contamination to water supply production and  
4       distribution."

5                       Do you see that?

6           A       Yes.

7           Q       Okay. So within that paragraph, there's  
8       a sentence that starts, "The supply of drinking  
9       water to Tarawa Terrace."

10                      Do you see that?

11          A       Yes.

12          Q       Okay. So that says, "The supply of  
13       drinking water to Tarawa Terrace was composed of two  
14       components. One, the supply of water from  
15       groundwater wells to the Tarawa Terrace Water  
16       Treatment Plant; and two, the delivery of finished  
17       water from the water treatment plant through the  
18       network of pipelines and storage tanks of the water  
19       distribution system."

20                      Did I read that correctly?

21          A       Yes.

22          Q       Does that mean that the Tarawa Terrace  
23       drinking water supply, from the period that the  
24       ATSDR modeled, consisted of water supplied from  
25       groundwater wells that went to the Tarawa Terrace

1 Water Treatment Plant and after going through the  
2 plant they were delivered as finished water to the  
3 housing or other buildings on the Tarawa Terrace  
4 water distribution system?

5 A That's correct.

6 Q Okay. And just going onto the next page,  
7 so page A18 -- actually, sorry. If you could go  
8 onto page A19?

9 So one more page.

10 A Okay.

11 Q And there's a table "A6." Do you see  
12 that?

13 A Yes.

14 Q It says, "Historical operations for  
15 water-supply wells, 1952 to 1987, Tarawa Terrace and  
16 vicinity, U.S. Marine Corps Base Camp Lejeune, North  
17 Carolina."

18 Is this table then showing all of the  
19 water supply wells that were providing water to the  
20 Tarawa Terrace Water Treatment Plant through that  
21 1952 to 1987 time span?

22 A That's the data that ATSDR presented --

23 Q Okay.

24 A -- yes.

25 Q So according to this table then, in the

1 column on the left that says "well identification,"  
2 do you see the --

3 A Yeah.

4 Q -- "TT-23."

5 So "TT-23"?

6 A Yes.

7 Q And does -- is this table saying that  
8 that well started supplying water in August of 1984?

9 A Yes, I see that.

10 Q Okay. And then it -- it's saying that it  
11 was offline in February of 1985; is that right?

12 A Yes, it says that.

13 Q And now the same table, looking at well  
14 that's "TT-26," so TT-26?

15 A Yes.

16 Q Is the table reflecting that that well  
17 started supplying water in January of 1952?

18 A Yes.

19 Q And was offline in July and August of  
20 1980 and January and February of 1983, is that  
21 correct?

22 A Yes.

23 Q And then the -- its service was  
24 terminated in February of 1985?

25 A Yes.

1           Q       And sorry, going back up to Tarawa  
2 Terrace, TT-23 --

3           A       Yes.

4           Q       -- does the table reflect that service  
5 was terminated from TT-23 in May of 1985?

6           A       Yes, it says that.

7           Q       And if you could set aside this exhibit,  
8 Exhibit 3, for a moment.

9                   MS. O'LEARY: And if we could get  
10 57, this will be Government Exhibit 7.

11                   (Whereupon, Government's Exhibit Aral  
12 7, ATSDR's Chapter C Report for  
13 Tarawa Terrace, was marked for  
14 identification.)

15                   THE WITNESS: Thank you.

16 BY MS. O'LEARY:

17           Q       So Professor Aral, on Government -- oops,  
18 I think I handed you the wrong one. I did. I have  
19 the one with the sticker.

20                   So let me trade you so you have the --

21           A       Okay.

22           Q       -- one that's marked.

23                   So on Government Exhibit 7, do you agree  
24 this is -- looks like a copy of the ATSDR's chapter  
25 C report for Tarawa Terrace?

1 A Yes.

2 Q Okay. And if you could go to page C76,  
3 please?

4 A Yes.

5 Q Okay. And do you see a table C3.10?

6 A Yes.

7 Q And it says, "Capacity and operational  
8 history of water supply well TT-23 Tarawa Terrace,  
9 U.S. Marine Corps Base Camp Lejeune, North  
10 Carolina."

11 A Yes.

12 Q Do you agree this is the ATSDR's table  
13 showing capacity and operational well history at  
14 TT-23, which is a supply well?

15 A Yes.

16 Q And do you agree this table shows that  
17 ATSDR concluded TT-23 was out of service in February  
18 of 1985?

19 A I am not the author of this report so if  
20 it says that here, that's what it should be.

21 Q Okay. Do you see on this table in -- the  
22 date, it says -- the second to last entry, it says,  
23 "Four, 1985, service terminated."

24 Do you see that?

25 A Table six, three, ten or what?



1 Or what num- --

2 Q Table C310. So the same --

3 A Yeah.

4 Q -- table we have been looking at --

5 A Okay.

6 Q -- that's --

7 A Uh-huh.

8 Q -- the entry for -- if -- that starts,

9 "Four --

10 (Whereupon, the court reporter  
11 requests clarification.)

12 BY MS. O'LEARY:

13 Q "Four 1985," in the date column.

14 MR. DEAN: Four, slash, 1985 --

15 MS. O'LEARY: Right.

16 MR. DEAN: -- next to last entry on  
17 the bottom.

18 BY MS. O'LEARY:

19 Q So we are looking at the column on the  
20 left --

21 A Okay.

22 Q -- that says date --

23 A Okay.

24 Q Yeah, the entry that starts, "4/1985."

25 Do you see that?

1 A I don't see that.

2 Where do you --

3 Q So on my copy, it's right here.

4 A Okay. Right there.

5 Okay.

6 Q Do you see it?

7 A Yeah.

8 Q And then -- so that's April 1985,

9 correct?

10 A Yeah.

11 Q And it says, "Service terminated."

12 Correct?

13 A Yeah.

14 Q Do you know why this table says TT-23  
15 service was terminated in April of 1985, but the  
16 last table we just looked at, table A6, says TT-23  
17 service was terminated in May of 1985?

18 MR. DEAN: Mis- --

19 A I --

20 MR. DEAN: I'm going to object to  
21 the form of the question. It also  
22 mischaracterizes the document.

23 You are also misrepresenting what  
24 the table says because in the entry just  
25 below -- above that it says, "4/30/1985,"

1           which is the end of the month, out of  
2           service.

3                       So you are mischaracterizing the  
4           chart and I'd ask that you provide the  
5           witness with accurate information,  
6           please.

7                       MS. O'LEARY: I don't see where it  
8           says "4/30" on this exhibit.

9                       MR. DEAN: It -- it does. If you  
10          look just above the entry you just read,  
11          you didn't --

12                      MS. O'LEARY: Oh, that one? Okay.

13                      MR. DEAN: Oh. Yeah, that one.

14           A           I'm not the author of this chapter so I  
15          have no comment.

16          BY MS. O'LEARY:

17           Q           Okay. You mean, you don't know?

18           A           I don't know whether it was terminated at  
19          this date or the other date or whether the other one  
20          was correct. I think the authors of the chapters  
21          should answer that question.

22           Q           Okay. And Professor Aral, could you go  
23          back to the Tarawa Terrace chapter A report, which  
24          should be marked as Government Exhibit 3?

25           A           Uh-huh.

1 Q And then go to page A27.

2 A Yes.

3 Q Okay. Do you see a table A9 on that  
4 page?

5 A Yes.

6 Q And it's labeled, "Summary of  
7 model-derived values and observed data of  
8 tetrachloroethylene at water supply wells Tarawa  
9 Terrace, U.S. Marine Base Camp Lejeune, North  
10 Carolina."

11 Did I read that correctly?

12 A Yes.

13 Q And the -- the data in this table, is  
14 this the sort of data you were relying on when you  
15 were building the models at Tarawa Terrace?

16 A Yes. This must be the data that we  
17 relied on.

18 Q Okay. And do you agree that table A9  
19 purports to summarize observed and model-simulated  
20 values of PCE at the Tarawa Terrace water supply  
21 wells?

22 A Can you speak louder, please?

23 Q Yeah, I'm sorry.

24 Do you agree that table A9 summarizes  
25 observed and model-simulated values of PCE at the

1 Tarawa Terrace water supply wells?

2 A Unless there's a typo -- typo error, it  
3 must be the correct numbers.

4 Q Okay. And do you agree that according to  
5 this table, between -- between January of 1952, so  
6 the earliest date on this table --

7 A Uh-huh.

8 Q -- and December of 1987, PCE was detected  
9 in only Tarawa Terrace 26. So TT-26, TT-23 and  
10 TT-25.

11 So looking at the column on, "Observed  
12 data for PCE concentration."

13 A Uh-huh.

14 Q So --

15 A Yes, I see that.

16 Q All right.

17 MS. BAUGHMAN: I'm going to object  
18 to the form. That's not correct.

19 BY MS. O'LEARY:

20 Q And so if we start with the section on  
21 supply well TT-23, you agree there are detections of  
22 PCE in TT-23?

23 A Yes, I saw that.

24 Q And do you agree that the highest PCE  
25 detection on the table was 132 micrograms per liter,

1 and that's from January 16, 1985.

2 Is that correct?

3 A That's correct.

4 Q And do you agree that for TT-23, there  
5 were non-detections, meaning no PCE detected, in  
6 February of 1985, in April of 1985, and July of  
7 1991?

8 MR. DEAN: Object to the form.

9 A Yes, I see that here.

10 BY MS. O'LEARY:

11 Q Okay. And looking at the -- the next  
12 supply well, so supply well TT-25, the next section.

13 A Uh-huh. Yes.

14 Q Do you agree that the only PCE detection  
15 in -- detections in TT-25 were 0.43 micrograms per  
16 liter in September of 1985, and 23 micrograms per  
17 liter in July of 1991?

18 A Yes, I see that.

19 Q Do you know what the "J" means next to  
20 the "0.43"?

21 A "J"?

22 Q Yeah. If you look at the entry for  
23 September 1985 for supply well TT-25, the PCE  
24 concentrations says, "0.43 J."

25 A I didn't notice that even.

1 Q Okay.

2 A I don't know what it means.

3 Q Okay. And do you agree that at supply  
4 well TT-25, there were non-detections of PCE in  
5 February, in April of 1985, as well as October,  
6 November, and December of 1985?

7 MR. DEAN: Object to the form.

8 A I see that.

9 BY MS. O'LEARY:

10 Q Okay. And at -- if we go down to supply  
11 well TT-30, TT-31, TT-52, TT-54, TT-67, and RW1,  
12 there are only non-detections of PCE listed.

13 Is that correct?

14 A I see that, yes.

15 Q But then for supply well RW2, there is a  
16 detection.

17 A I see that, yes.

18 Q And that's in 1991?

19 A Yeah.

20 Q And then at supply well RW3, only a  
21 non-detection.

22 A Yes.

23 Q Okay. Could you go, in the same report,  
24 so still Tarawa Terrace chapter eight, to page 40 of  
25 this?

1                   And the page A40, it should say -- the  
2                   label should say, "Concentration of  
3                   tetrachloroethylene, PCE, in finished water."

4                   A           Yes.

5                   Q           Do you see that?

6                   All right. In the first paragraph on the  
7                   left column that starts, figure A18 -- do you see  
8                   where I am?

9                   A           Yes, I see that.

10                  Q           All right. The next sentence -- no, not  
11                  the next one.

12                  About --

13                  A           "A monthly listing of..." --

14                  Q           Just a second.

15                  All right. Near the bottom of that first  
16                  paragraph --

17                  A           Uh-huh.

18                  Q           -- there's a line that starts with a  
19                  number, "1.3 micrograms per liter."

20                  Do you see that?

21                  A           Yes.

22                  Q           Okay. Right next to that, there's a  
23                  sentence that starts, "The PCE concentration of  
24                  finished water at the Tarawa Terrace Water Treatment  
25                  Plant is less than the PCE concentration of water



1 supply well TT-26 because the mixing model uses  
2 water supplied to the water treatment plant from all  
3 wells, contaminated and uncontaminated."

4 Do you see that?

5 A That's correct.

6 Q And do you agree that the PCE  
7 concentration in water distributed from the Tarawa  
8 Terrace Water Treatment Plant had lower PCE  
9 concentrations than in TT-26?

10 A We can look at the data. If that's the  
11 case, that might be.

12 Q I mean --

13 A Yeah.

14 Q -- do you agree with what the document  
15 says?

16 A That's what the document says, yes.

17 Q Okay. Do you have any reason to think  
18 that's not true?

19 A No, I don't have any reason to think  
20 that's not true.

21 Q Okay. And then in the same paragraph,  
22 still on page A40 --

23 A Yes.

24 Q -- but a little farther up, there's a  
25 line that starts -- it's the one, two, three, four,

1 five -- the seventh line down that's -- on the left  
2 the first word is, "Period."

3 A Okay.

4 Q Okay. At the end of that row, there's a  
5 sentence that says, "PCE contamination of water  
6 supply well TT-26 was the primary contributor to  
7 contamination in the finished water of the water  
8 treatment plant."

9 Do you agree that TT-26 was the primary  
10 contributor of PCE contamination to Tarawa Terrace  
11 Water Treatment Plant?

12 A Yes, I do.

13 Q And do you agree -- looking back at table  
14 A6, which is on page A19, that according to the  
15 ATSDR --

16 MR. DEAN: Give him time to get  
17 there, if you don't mind?

18 MS. O'LEARY: Sure.

19 BY MS. O'LEARY:

20 Q So this was A19.

21 A Uh-huh.

22 Q Okay. Do you agree that this shows that  
23 TT-26 had its service terminated in February of  
24 1985?

25 A Which table are we looking at?

1 Q A6.

2 A A6. Okay.

3 Q So in the --

4 A Yeah.

5 Q Don't --

6 Service terminated TT-26, February 1985;  
7 you agree?

8 A Yup.

9 Q Okay. So if TT-26 was the primary  
10 contributor of PCE to the Tarawa Terrace Water  
11 Treatment Plant and it shut down in February of  
12 1985 --

13 A Uh-huh.

14 Q -- do you agree that after that happened,  
15 PCE concentrations at Tarawa Terrace Water Treatment  
16 Plant would have significantly decreased?

17 A Would have decreased, yes. Significantly  
18 or not it depends on the contributions of the other  
19 wells.

20 Q Well, if it's the primary contributor --

21 A Yeah, of course.

22 Q -- doesn't that make it significant  
23 decreases?

24 MR. DEAN: Object to form.

25 A I don't think so.

1 BY MS. O'LEARY:

2 Q Why not?

3 A Because the contribution is not only  
4 coming from TT-26 --

5 Q Uh-huh.

6 A -- but other wells as well.

7 We have to go back and look at all the  
8 other contaminant concentrations in all the other  
9 wells to see whether it's significant or not.

10 Q Sure. So if we go to table A9 again,  
11 which was on page A27 --

12 A Twenty-seven.

13 Okay.

14 Q And -- and I think we went through this  
15 earlier, but the highest detection of PCE at TT-23  
16 was 132 micrograms per liter.

17 And at TT-25, the highest detection  
18 before 1987 was 0.43 micrograms per liter. And  
19 there were no detections in any other wells before  
20 1987 --

21 A Uh-huh.

22 Q -- is that correct?

23 And then if we look at --

24 MR. DEAN: You didn't read, with all  
25 due respect, or for the record, that this

1 is "0.43 J."

2 And 0.43 J, the "J" means estimated.

3 THE WITNESS: Okay.

4 MS. O'LEARY: I don't -- I don't

5 know that that's accurate.

6 BY MS. O'LEARY:

7 Q But if we look then at supply well TT-26,  
8 the highest concentration there, it looks like it's  
9 1,580 micrograms per liter. So almost -- more than  
10 ten times higher than the next highest concentration  
11 in a well.

12 Do you agree?

13 A Which one are you referring to?

14 Q I'm on page A27, table A9?

15 A Yes.

16 Q All right. So --

17 A Okay.

18 Q So if we look at TT-26 --

19 A Yes.

20 Q -- its highest concentration measured is  
21 the 1,580 --

22 A That's correct.

23 Q -- micrograms per liter, and that's more  
24 than ten times higher than the 132 micrograms per  
25 liter, that's the highest measured concentration in

1 another supply well before 1987.

2 Do you see that?

3 A Which well are you comparing this 1580  
4 number with?

5 Q All of the other wells.

6 A Can you speak louder, please?

7 Q Yeah. All the other wells.

8 But the specific --

9 A All the other wells?

10 Q Yeah.

11 A Combined?

12 Q No, not combined.

13 Individually.

14 A Individually, they are less than 1580.

15 Q I mean, more than ten times less than  
16 1580, right?

17 A Yeah.

18 Q Okay. And if you could go to page A18 --

19 MR. DEAN: For the record, on page  
20 A27, at the top in the definitions, under  
21 the table A9, in parentheses, it gives a  
22 definition of the "J."

23 It says, "Estimated."

24 BY MS. O'LEARY:

25 Q And Professor Aral, are you on page A18?

1           A       Yes.

2           Q       Okay. And there's a large figure that  
3 covers most of the page. The text at the bottom is  
4 where --

5           A       Okay.

6           Q       -- I'd like to direct your attention.

7                   The column on the left, there's a  
8 sentence that begins, "Once a well was put in  
9 service." It's the third line from the bottom.

10                   Do you see that?

11          A       Yes.

12          Q       Okay. So that says, "Once a well was put  
13 in service, it was assumed to operate continuously  
14 for modeling purposes until it was permanently taken  
15 offline, the exception being temporary shutdowns for  
16 longterm maintenance. Breaks in continuous  
17 operation, such as those for wells TT-26 and TT-53,  
18 are also shown on figure A5 and are based on  
19 documented information detailing periods of  
20 maintenance for a specific wells."

21                   Did I read that correctly?

22          A       You read that correctly.

23          Q       Is it true that in the ATSDR model,  
24 Tarawa Terrace supply wells were modeled such that  
25 they are assumed to operate continuously unless

1 there was documentation that they had been  
2 temporarily shut down for maintenance?

3 A That's correct.

4 Q And if you could go onto page A20 of the  
5 Tarawa Terrace report?

6 Can you go onto page --

7 A A what?

8 Q A20.

9 Just one -- two pages forward.

10 A Okay.

11 Yes.

12 Q And there's a figure A6 on the bottom.  
13 Do you see that?

14 A Yes.

15 Q Okay. It's labeled, "Total annual  
16 groundwater pumpage at water supply wells, 1952 to  
17 1987, Tarawa Terrace and vicinity, U.S. Marine Corps  
18 Base Camp Lejeune, North Carolina."

19 And --

20 A You have to speak sl- --

21 Q Yeah.

22 On this table --

23 A Yeah.

24 Q -- A6, is -- is this showing -- I guess  
25 my first question is: What is pumpage of a water



1 supply well?

2 A The amount of water contributed to water  
3 treatment plant.

4 Q Okay. So is table A6 showing the amount  
5 of water that the -- at the Tarawa Terrace Water  
6 Treatment Plant that the ATSDR model had coming from  
7 each well at each year?

8 A At each year at each --

9 Q For each --

10 A -- pumping --

11 Q -- well?

12 A Yeah, okay.

13 Yes.

14 Q Okay. And do you agree that in looking  
15 at A6, TT-26 and TT-23 are not modeled as  
16 contributing any water to the Tarawa Terrace Water  
17 Treatment Plant in 1986 and 1987?

18 A That's right.

19 Q Okay. And so the wells where  
20 contamination was detected before 1987, we had  
21 TT-26, TT-23, and TT-25.

22 Is that correct?

23 A Uh-huh. Yes.

24 Q Okay. So according to figure A6, for  
25 1986 and 1987, the only well that the ATSDR's Tarawa

1 Terrace model of those three that was still pumping  
2 was TT-25.

3 Is that right?

4 A Repeat that question, please?

5 Q Yeah. So on figure A6, for just the last  
6 two years, 1986 and 1987 --

7 A Yes.

8 Q -- of -- of the three wells where  
9 contamination was found before 1987, the only one  
10 that the ATSDR model had as contributing water to  
11 the Tarawa Terrace Water Treatment Plant in '86 and  
12 '87, was TT-25.

13 Is that correct?

14 A TT-25?

15 TT-25, yes. It's contributing, according  
16 to this figure, yes.

17 Q But TT-26 and TT-23 are not --

18 A Are not.

19 Q -- correct?

20 A Yes.

21 Q Okay. And TT-25 was the well that had  
22 the only detection before 1987 of PCE was 0.43  
23 micrograms per liter with the "J"?

24 A Yes.

25 Q Still in Tarawa Terrace chapter A, so the

1 same exhibit, but could you go to page A93?

2 A Yes.

3 Q All right. So this is -- says it's  
4 appendix A2.

5 I'll give you a minute to get to that.  
6 All right.

7 So we are looking at appendix A2, where  
8 it says, "Simulated tetrachloroethylene and its  
9 degradation by-products in finished water, Tarawa  
10 Terrace Water Treatment Plant, January 1951 to  
11 March 1987, continued."

12 So is this the simulated P- -- or  
13 contaminant concentration levels from the ATSDR's  
14 Tarawa Terrace model?

15 A It has -- this -- this table includes the  
16 MT3DMS results as -- also, TechFlowMP results.

17 Q Okay. But both of those aren't, like --  
18 those are the simulated concentrations from the  
19 Tarawa Terrace water model; is that correct?

20 A That's correct.

21 Q All right. So if I -- the column on the  
22 left is called "Stress periods." And I want to look  
23 at the -- the last two. So four, 30 -- well,  
24 actually, not quite the last -- the last three. 433  
25 and 434, that say they are January 1987 and

1 February 1987.

2 Do you see that?

3 A Yes.

4 Q And do you agree on the MT3D model, those  
5 show PCE concentrations of 17.85 micrograms per  
6 liter and 18.49 micrograms per liter?

7 A Yes.

8 Q And on the TechFlowMP version, it shows  
9 8.28 micrograms per liter and 8.71 micrograms per  
10 liter of PCE.

11 A Yes.

12 Q Okay. And these levels in appendix A2,  
13 that's at the water treatment plant; correct?  
14 That's all of the wells' contributions, combined?

15 A Yes.

16 Q So the only well contributing in this  
17 simulation where there was a detection of PCE is  
18 TT-25, right?

19 A According to the earlier pumpage records.

20 Q Okay.

21 A TT-25 --

22 Q Yeah.

23 A -- is there, TT-28 is there, TT-54 is  
24 there --

25 Q Uh-huh.

1           A       -- and TT-27 is there. That's what I  
2       see.

3           Q       Okay. And -- but of those wells, it was  
4       only TT-25 that had a detection of PCE?

5           A       In terms of site observations --

6           Q       Right.

7           A       -- or in terms of simulated results?

8           Q       In terms of site observations.

9           A       That's what was on the table, yes.

10          Q       Okay. We can set aside Tarawa Terrace  
11       chapter A for a few minutes.

12          A       Okay.

13                   MS. O'LEARY: If you can grab seven.  
14                   (Whereupon, Government's Exhibit Aral  
15                   8, December 2004 Report by AH  
16                   Environmental Consultants, Inc., was  
17                   marked for identification.)

18       BY MS. O'LEARY:

19          Q       So Professor Aral, Government Exhibit 8  
20       should be -- it looks like a report that's labeled,  
21       "ATSDR Support Estimation of VOC Removal, Marine  
22       Corps Base Camp Lejeune."

23                   And it says the date is December 2004,  
24       and it's by AH Environmental Consultants, Inc.

25                   Do you see that?

1           A       Yes.

2           Q       Have you ever seen a report from AH  
3   Environmental Consultant, Inc.'s [sic]  
4   about estimating VOC removal ATSDR -- for ATSDR  
5   before?

6           A       I don't recall that.

7           Q       Okay. Can you go to -- this one is  
8   numbered interestingly -- but page five, dash,  
9   one -- you know what might be easiest, do you see  
10   the -- there's little numbers at the bottom that  
11   all -- right --

12          A       Yeah.

13          Q       -- that start, "CLJA water modeling,"  
14   yeah. Can you go to the page where the last part of  
15   that is -71486?

16          A       Yes.

17          Q       Okay. So this is labeled, "Summary," and  
18   it --

19          A       Uh-huh.

20          Q       -- says, "Where MCB Camp Lejeune is  
21   currently the subject of an epidemiological study by  
22   the ATSDR to ascertain the health impacts of certain  
23   VOCs including TCE and PCE, which were present in  
24   the Hadnot Point, Tarawa Terrace, and Holcomb  
25   Boulevard water supply systems in the early 1980s.

1 AH assisted in the development of referenced  
2 estimates of the VOC removal rates that might have  
3 occurred within the treatment units that existed at  
4 the three plants during 1968 to 1985."

5 Were you aware that AH Environmental  
6 had -- had assisted in the development of referenced  
7 estimates of VOC removal rates that might have  
8 occurred at the treatment plants?

9 A No, I have not.

10 Q Okay. And the same page, the third  
11 paragraph, it says, "The calculations revealed that  
12 VOC removal due to volatization -- volatilization  
13 from quiescent basins was negligible at MCB Camp  
14 Lejeune. The only significant VOC removals must  
15 have occurred at the spiractor effluent pipe where  
16 the falling water undergoes some aeration.  
17 Considering the uncertainty in the estimates for the  
18 fall height over the weir formed by the pipe, the  
19 removal for TC- -- removals -- excuse me -- for TCE  
20 and PCE were likely to be less than 15 percent."

21 A Yes.

22 Q Do you agree that the date range  
23 referenced in this page, the 1968 to 1985, that  
24 corresponds to the epidemiological study that the  
25 Tarawa Terrace water modeling was supporting?

1           A           The period of "epi" study -- yes, that's  
2           what it was.

3           Q           Okay. And -- so do you agree that this  
4           report is saying that AH Environmental, who authored  
5           it, estimated VOC losses of TCE and PCE from  
6           spiractors at the water treatment plant would be  
7           significant, though they estimated them as less than  
8           15 percent?

9                       MR. DEAN: Object to the form of the  
10                      question. Out -- this is not something  
11                      for which this witness has opined on.

12          A           I haven't seen this report before. I  
13          haven't seen these calculations before so I can't  
14          answer that question.

15                      MS. O'LEARY: Okay. Can we get --  
16                      you can set this aside for a minute. And  
17                      could we get 60, please?

18                      This will be Government Exhibit 9.  
19                      (Whereupon, Government's Exhibit Aral  
20                      9, ATSDR's Chapter F, "Simulation of  
21                      the Fate and Transport of  
22                      Tetrachloroethylene, PCE, for Tarawa  
23                      Terrace," was marked for  
24                      identification.)  
25



1 BY MS. O'LEARY:

2 Q So Professor Aral I've handed you  
3 Government Exhibit 9, that appears to be the ATSDR's  
4 chapter F, "Simulation of the Fate and Transport of  
5 Tetrachloroethylene, PCE, for Tarawa Terrace."

6 A Yes.

7 Q Do you agree that's what this exhibit --

8 A Yeah.

9 Q -- appears to be?

10 Okay. And can you go to page F42?

11 A Yes.

12 Q All right. Professor, in the column on  
13 the left, it says, "Level four calibration."

14 Do you see that?

15 A Yes.

16 Q Okay. After that, it says, "The final  
17 stage of model calibration employed a simple mixing  
18 flow-weighted average model to compute PCE  
19 concentrations delivered to the Tarawa Terrace Water  
20 Treatment Plant from all active water supply wells  
21 and, subsequently, to the Tarawa Terrace water  
22 supply network. For each stress point month of the  
23 simulation period, from January 1951 to  
24 December 1994, the PCE concentration simulated at  
25 each active water supply well is weighted by the

1     respective well discharge to compute a  
2     weighted-average PCE concentration. This  
3     weighted-average concentration was considered the  
4     monthly average PCE concentration delivered to the  
5     Tarawa Terrace Water Treatment Plant."

6             A        Yes.

7             Q        One question: When this mentions "well  
8     discharge," does that mean the water coming out of  
9     the well and going to the water treatment plant?

10            A        Yes.

11                    MR. DEAN: Object to the form.

12            A        Yes.

13     BY MS. O'LEARY:

14            Q        And do you agree that a -- a simple  
15     mixing flow-weighted average has no calculation  
16     where contaminants in the water coming out of a well  
17     are lost from the water supply before being  
18     distributed?

19            A        Can you repeat that --

20            Q        Sure.

21            A        -- question.

22            Q        Do you agree that a simple mixing  
23     flow-weighted average --

24            A        Uh-huh.

25            Q        -- calculation does not have a

1 calculation where contaminants in the water from  
2 wells is lost in the water treatment plant?

3 MR. DEAN: Object to the form.

4 A Where -- where does the loss come into  
5 this calculation --

6 MR. DEAN: That's --

7 A -- in your understanding? I don't  
8 understand that.

9 BY MS. O'LEARY:

10 Q I don't -- I'm not trying to suggest it  
11 does, Professor Aral. I'm trying to confirm that --  
12 I'm understanding correctly that there is no loss  
13 calculation of contaminants in a simple mixing  
14 flow-weighted average calculation.

15 MR. DEAN: Object to the  
16 statement --

17 A At the water treatment plant?

18 BY MS. O'LEARY:

19 Q At the water treatment plant?

20 A Yeah. Yeah. That's what it means.

21 Q Okay. So you would agree that in a  
22 simple mixing flow-weighted average calculation,  
23 no -- no contaminants that enter the water treatment  
24 plant are modeled to be lost in the water treatment  
25 plant?

1 MR. DEAN: Object to form.

2 A Well, that's -- what numbers are we using  
3 to calibrate the water treatment plant database is  
4 important here. But that equation does not include  
5 contaminant losses, definitely.

6 BY MS. O'LEARY:

7 Q Okay. Would you agree that a simple  
8 mixing flow-weighted average does not have any  
9 calculation to simulate physical processes whereby  
10 contaminants could be loss in treatment?

11 A That's correct.

12 Q Okay. Professor Aral, do you agree that  
13 the ATSDR Tarawa Terrace model simulated PCE  
14 concentrations in water coming out of the water  
15 treatment plant as the same as the mixture of water  
16 entering the water treatment plant?

17 A It depends on the data available. If the  
18 data we have used or ATSDR has used is the treated  
19 water, that's the -- that should include the losses  
20 that is happening in the water treatment --

21 Q Uh-huh.

22 A -- plant. If not, it's just the entry  
23 concentrations.

24 Q My question is -- is about how the model  
25 function not about which data it was calculated to.

1           A           The mixing model does not include any  
2   loss effects.

3           Q           Okay. And the mixing model is what was  
4   used to simulate the water treatment plant in the  
5   ATSDR's model; is that correct?

6           A           That's correct.

7           Q           If we go back to Exhibit 8, which was  
8   that report from AH Environmental --

9           A           Yes.

10          Q           -- it's the one that had on page 5-1, but  
11   it's -- at the bottom right -- -71486.

12          A           Yes.

13          Q           Okay. That last paragraph, the last  
14   sentence, is where it says, "Considering the  
15   uncertainty and the estimates over the fall height  
16   from weir formed by the pipe, the removals for TCE  
17   and PCE were likely to be less than 15 percent."

18                   Now, I understand you, you know,  
19   you haven't --

20          A           You have to speak louder, please.

21          Q           Sure.

22                   So I understand you didn't -- you haven't  
23   seen this report before. I just have a -- a  
24   question about, you know, what could be done on the  
25   Tarawa Terrace model.

1           Could you have applied a percentage  
2       reduction to the numbers that come out of the Tarawa  
3       Terrace mixing model?

4                       MR. DEAN:   Object to the form of  
5                       the --

6           A       Arbitrarily?

7                       MR. DEAN:   -- question.

8       BY MS. O'LEARY:

9           Q       Well, no.   Not arbitrarily --

10          A       I mean --

11          Q       -- but -- but could you -- I mean, just  
12       as a calculation, could that have been done?

13          A       Right.

14                       MR. DEAN:   Object to the form.

15          A       We -- we wouldn't do that.

16       BY MS. O'LEARY:

17          Q       What do you mean?

18          A       We wouldn't --

19          Q       Who is "we"?

20          A       We wouldn't apply a certain percentage of  
21       loss, in quotes, arbitrarily to any computation of  
22       our environment.

23          Q       I -- I understand that.   I don't mean to  
24       suggest you would.

25                       My -- my question is though, like, if the

1 ATSDR had, you know, told you that they estimated  
2 treatment losses at a certain percentage, could you  
3 have applied that percentage to reduce the simulated  
4 values?

5 A We wouldn't do that.

6 Q Why not?

7 A Because we have to compute something that  
8 we use. It's that -- simple as that.

9 Q What do you mean you have to compute  
10 something you use?

11 A If there's a certain loss in a process --

12 Q Uh-huh.

13 A -- we have to model that, understand that  
14 process, and that process gives us a certain  
15 percentage of loss. And then we can use that number  
16 as the outcome of treatment at water --

17 Q Okay.

18 A -- treatment plant.

19 Q So if someone else had calc- -- had  
20 calculated what that would be, you could have used  
21 it?

22 A In ATSDR calculations on Camp Lejeune, we  
23 never relied on somebody else's calculations, we  
24 relied on our calculations.

25 Q Right.

1 A You just said --

2 Q Well, I'm --

3 A -- if somebody else --

4 Q Uh-huh.

5 A -- has calculated something, wouldn't you  
6 have used it?

7 My answer is no.

8 Q But couldn't someone -- some other part  
9 of ATSDR other than MESL have done that and given it  
10 to you to --

11 A If --

12 Q -- use?

13 A If they had done an analysis of that,  
14 yes, of course.

15 Q Okay. And would you expect to see gains  
16 in contaminant concentrations going through a water  
17 treatment plant?

18 A That's very unusual.

19 Q Why is that very unusual?

20 A If you treat some chemical through a  
21 treatment plant, it's supposed to reduce the  
22 concentration.

23 Q Okay. And Professor Aral, would you like  
24 to take a -- a break or would you like to keep  
25 going?



1           A       I'm okay.

2           Q       Okay.

3                   MS. BAUGHMAN: I think we are having  
4 lunch at noon so you want to keep going  
5 for 20 minutes?

6                   MS. O'LEARY: Sure.

7                   MS. HORAN: Can we just take a  
8 two-minute break for water and then can  
9 take a break in 20 minutes for our lunch  
10 break?

11                  MS. BAUGHMAN: Sure.

12                  MS. O'LEARY: All right. Can we go  
13 off record for -- just briefly.

14                  THE VIDEOGRAPHER: The time right  
15 now is 11:39 a.m. We are off the record.

16                   (Whereupon, there was a recess taken  
17 from 11:39 a.m. to 11:39 a.m.)

18                  THE VIDEOGRAPHER: The time right  
19 now is 11:39 a.m. We are back on the  
20 record.

21                  MS. O'LEARY: Thank you. Professor  
22 Aral, we are going to stay in the same  
23 exhibit, it's the Tarawa Terrace chapter  
24 A report.

25                   Oh, sorry. I guess that's not the

1 same, is it? It's going back from the  
2 environmental report. It should be -- it  
3 should have --

4 THE WITNESS: Chapter A?

5 MS. O'LEARY: Chapter A. It  
6 should have a sticker that says --

7 THE WITNESS: Exhibit 3?

8 MS. O'LEARY: -- Government  
9 Exhibit -- yes.

10 THE WITNESS: Okay.

11 MS. O'LEARY: You are ahead of me.

12 THE WITNESS: Okay.

13 BY MS. O'LEARY:

14 Q Okay. Can you go to page A26 in the --  
15 you should see a table A8.

16 A Yes.

17 Q Okay. So this table, it says it's a,  
18 "Summary of calibration targets and resulting  
19 calibration statistics for simulation models used to  
20 reconstruct historical contamination events at  
21 Tarawa Terrace and vicinity, U.S. Marine Base Camp  
22 Lejeune, North Carolina."

23 And the question I have for you is about  
24 the third line. So the column on the left says  
25 there's a "calibration level" and then next to it it

1 says "analysis type."

2 So the Calibration Level 3 says it's,  
3 "Contaminant fate and transport supply wells."

4 Do you see that?

5 A Yes.

6 Q And then is -- is this saying that the  
7 calibration target for contaminant fate and  
8 transport at the supply wells was one half order of  
9 magnitude or model bias ranging from 0.3 to 3?

10 A That's what it says, yes.

11 Q Okay. And is it -- is it saying if you  
12 look at number four the calibration level four --  
13 (Whereupon, the court reporter  
14 requests clarification.)

15 BY MS. O'LEARY:

16 Q The calibration level four, is it saying  
17 the -- for the mixing model treated water at the  
18 water treatment plant --

19 (Whereupon, the court reporter  
20 requests clarification.)

21 BY MS. O'LEARY:

22 Q Treated water at the water treatment  
23 plant, the calibration target is the same as in  
24 contaminate fate and transport at supply wells. So  
25 that plus or minus one half order of magnitude or

1 model bias ranging from 0.3 to 3.

2 A Yes, I see that.

3 Q Okay. Is --

4 MR. DEAN: For the record, the  
5 document reflects that there are two  
6 footnotes. Specifically, footnote number  
7 two that's applicable to calibration  
8 levels three and four and you did not  
9 point that out to the witness.

10 MS. O'LEARY: Okay. That -- that  
11 footnote says there's more details in  
12 chapter F report; correct?

13 MR. DEAN: Correct.

14 MS. O'LEARY: Yeah.

15 BY MS. O'LEARY:

16 Q So Professor Aral, you said that's what  
17 the table says. Is that your understanding of what  
18 the calibration targets for calibration levels three  
19 and four were, the plus or minus one half order  
20 magnitude or model bias ranging from 0.3 to 3?

21 A That's what the table says, yes.

22 Q But I mean, from your memory, is that  
23 what they in fact were, the calibration targets?

24 A I think we looked at the ensemble of what  
25 we see at the water treatment plant as opposed to

1 specific numbers being in a certain range.

2 Q Is that at Hadnot Point or Tarawa  
3 Terrace, where you looked at the ensemble?

4 A I think with respect to mixing model, it  
5 was also Tarawa Terrace.

6 Q Would that be in the Tarawa Terrace  
7 reports somewhere?

8 A I don't recall.

9 Q If we could go to -- this will be 60,  
10 which is Exhibit 9, that you should have. It's the  
11 chapter F report.

12 A Yes.

13 Okay.

14 Q Okay. On page 33 --

15 MR. DEAN: F33?

16 MS. O'LEARY: That's right.

17 MR. DEAN: Okay.

18 BY MS. O'LEARY:

19 Q And...

20 A Yes.

21 Q Okay. So Professor Aral, on F33, on the  
22 left-hand side you should see a table F13.

23 Do you see that?

24 A Yes.

25 Q Okay. And then -- oh, I'm sorry. I

1 directed you slightly off.

2 Can you go back one page to F32? So just  
3 the previous page.

4 Okay. Underneath the table there,  
5 there's some text. And in the column on the left  
6 there's a paragraph that begins, "Simulated and  
7 corresponding observed PCE concentrations at Tarawa  
8 Terrace and local water supply wells are listed in  
9 table F13 and are portrayed in this report as a  
10 scatter diagram, F12, and as time-series graphs at  
11 individual wells, figures F13 to F17."

12 Do you see that?

13 A Yes.

14 Q And then if we go onto the next page, we  
15 have F13, the table.

16 Do you see that?

17 A Yes.

18 Q And then there's a figure 12 as well on  
19 F33.

20 A Yes.

21 Q Do you see that?

22 Okay. So do you agree that table F13  
23 shows all of the supply well observed PCE  
24 measurements that were used for calibrating, in  
25 level three, the contaminant fate and transport

1 model?

2 A Can you speak louder, please?

3 Q Yeah.

4 Do you agree that table F13 --

5 A Yes.

6 Q -- shows the supply well observed  
7 measurements that were used for calibrating the  
8 contaminant fate and transport models, so level  
9 three?

10 A I believe so, yeah.

11 Q Okay.

12 A I mean, I have to check every one of them  
13 separately. If they have made a typo error, I'm not  
14 sure.

15 Q Okay. Do you have any reason to think  
16 they have made a typographical --

17 A I don't --

18 Q -- error?

19 A -- think so.

20 Q And as you look at table F13, do you  
21 agree that these observed measurements are only from  
22 the years 1984, 1985, and 1991?

23 A Where did you see the '84? I didn't see  
24 the '84.

25 Q Actually, right. I don't see the 1984.

1                   So only 1985 and 1991?

2           A       That seems correct.

3           Q       Okay. So if this table is the observed  
4       measurements that were used for calibrating  
5       contaminant fate and transport --

6           A       Yes.

7           Q       -- does that mean the Tarawa Terrace fate  
8       and transport model was calibrated without observed  
9       concentrations from 1953 to 1984?

10          A       That's correct.

11                   MS. O'LEARY: Then can we get 59?  
12                   (Whereupon, Government's Exhibit Aral  
13                   10, Document, was marked for  
14                   identification.)

15                   MS. O'LEARY: There you go. This  
16                   will be Government Exhibit 10.

17   BY MS. O'LEARY:

18          Q       And if you could go to page A10, please?

19          A       Yes.

20          Q       So there -- table E5 there says --

21          A       Yes.

22          Q       -- "Summary of selected analyses for  
23       tetrachloroethylene, PCE; trichloroethylene, TCE; and  
24       total dichloroethylene, DCE; and water samples  
25       collected at monitor wells during ABC One-Hour



1 Cleaners operable units one and two, and by the  
2 North Carolina Department of Natural Resources and  
3 Community Development, Tarawa Terrace and vicinity,  
4 U.S. Marine Base Camp Lejeune, North Carolina."

5 Do you see that?

6 A Yeah.

7 Q Am I correct in understanding that these  
8 PCE and TCE measurements from monitor wells around  
9 ABC One-Hour Cleaning -- Cleaners, excuse me, were  
10 not used in calculating the fate and transport model  
11 of Tarawa Terrace?

12 A If I recall this report, there were 36  
13 databases that were used. And if this is the 36  
14 database that -- that existed in that analysis, that  
15 must be it.

16 Q Well, if -- if you go back to Exhibit 9,  
17 which was chapter F that we were just looking at, we  
18 were just looking at table F13. So that was on page  
19 F33.

20 A Okay. I think this table refers to  
21 monitoring wells, the other table refers to pumping  
22 wells.

23 Q To supply wells, right?

24 A Supply wells.

25 Q Yes. And so am I correct in

1 understanding that these monitoring well  
2 measurements in table E5 were not used in  
3 calibrating the fate and transport model?

4 A I think you should ask the author of  
5 that.

6 As far as I know, the numbers of wells  
7 that were used in calibrating this model was 36.  
8 And that was the total available database at the  
9 site at that time.

10 Q Right. So just -- if we go back to table  
11 F13, that was on page F33, there are 36 entries --

12 A Okay. So --

13 Q -- in that table?

14 A Okay. If that's the case, then that's  
15 the 36 number that is coming to my mind.

16 Q So that's all that was used for  
17 calibrating --

18 A Right.

19 Q -- the fate and transport model?

20 MR. DEAN: Object to the form.

21 A That was reported in chapter F as such,  
22 yes.

23 BY MS. O'LEARY:

24 Q Okay. And I'm going to go back to Tarawa  
25 Terrace chapter A. And --

1                   MR. DEAN: I feel like I'm playing  
2                   tennis.

3 BY MS. O'LEARY:

4           Q       -- page A16.

5                   So I have some questions for you about  
6 mass loading at Tarawa Terrace.

7           A       Yes.

8           Q       Okay. On page A16, there is a figure,  
9 figure A3 that says it's a, "Chronology of events  
10 related to supply and contamination of drinking  
11 water, Tarawa Terrace and vicinity."

12                   Do you see that?

13          A       Yes.

14          Q       Okay. I see in figure A3 in -- there's  
15 an entry for 1953 that says "ABC One-Hour Cleaners  
16 begins operations using existing ST-STA" --

17                   (Whereupon, there was an  
18 interruption.)

19 BY MS. O'LEARY:

20          Q       -- "ST-STA for disposal of wastewater."

21                   Do you see that?

22                   It's --

23          A       Okay.

24          Q       -- here.

25          A       Yes.

1 Q Okay. Was the start date of ABC Cleaners  
2 used as an input in the Tarawa Terrace water models?

3 A I think it was 1953.

4 Q Okay. Was that input as a start of mass  
5 loading date in the Tarawa Terrace models?

6 A Yes.

7 Q Okay. Is the start of the mass loading  
8 significant to the output of the model?

9 MR. DEAN: Object to the form.

10 A It affects the output, yes.

11 BY MS. O'LEARY:

12 Q Okay. And did you -- no.

13 If I look again at figure A3, it says, in  
14 the -- the third bar down on the left, around  
15 1960 --

16 A Uh-huh.

17 Q -- the's an entry that says "1960s ABC  
18 One-Hour Cleaners installs floor drain to septic  
19 system."

20 Do you see that?

21 A Yes.

22 Q Okay. Did ABC -- did the ATSDR model of  
23 Tarawa Terrace include changes in the mass loading  
24 rate of PCE?

25 A Mass loading rate in our models were

1 calibration parameters. That's what we did in  
2 calibration, used numbers to adjust the mass loading  
3 rate to match the water --

4 (Whereupon, the court reporter  
5 requests clarification.)

6 A -- match the water treatment plant  
7 concentrations.

8 BY MS. O'LEARY:

9 Q Okay. But the input that was used in the  
10 calibrated TT-model for mass loading of PCE --

11 A Uh-huh.

12 Q -- was that constant throughout the  
13 Tarawa Terrace model timeframe from when it started  
14 to when it stopped?

15 A That's correct.

16 Q Okay. So does that mean the model did  
17 not have any change in mass loading that would  
18 correspond to this ABC One-Hour Cleaners installing  
19 floor drain to septic system?

20 A That -- that's a internal process where  
21 the contaminants gets into the aquifer system. We  
22 are not looking at the internal processes of how  
23 contaminants are manipulated in the ABC cleaners.  
24 We are interested in what is discharged into the  
25 aquifer as a dilute phase contaminant level.

1           Q       So if ABC Cleaners changes where they --  
2       where they discharged their -- you know, whatever  
3       waste had the PCE, if that changed location,  
4       wouldn't that change how the contaminant moved  
5       through the aquifer?

6                   MR. DEAN: Object to the form of the  
7       question.

8           A       I mean, if you are talking about acres of  
9       land and you are talking about distances of miles,  
10      kilometers, discharge points separately discharging  
11      into an aquifer, it would affect the groundwater  
12      models. But ABC Cleaners is -- I assume is a point  
13      in our modeling idealization.

14      BY MS. O'LEARY:

15           Q       What do you mean, is a point in our  
16      modeling idealization?

17           A       In modeling we use mesh -- meshes. We  
18      describe the aquifer in terms of blocks of  
19      subsurface environments --

20           Q       Uh-huh.

21           A       -- that we input parameters that we know  
22      are coming from the -- either the aquifer database  
23      or the source database. This model is so large that  
24      the ABC Cleaners entry point is just a point on that  
25      mesh.

1 Q And -- and --

2 A It can't be more than that.

3 Q So if I understand correctly, then it  
4 spreads through the mesh according to the way the  
5 model operates?

6 A That's correct.

7 Q Okay. But AB- -- but the model had just  
8 constant mass loading?

9 A Yes, constant mass loading.

10 Q Okay.

11 A Whatever the calibrated value was.

12 Q Uh-huh. And we are going to go back to  
13 chapter F again, which is Exhibit 9.

14 A Okay.

15 Q And to page 12.

16 A F12 --

17 Q Yes.

18 A -- did you say?

19 Q And there's a table on the left, and on  
20 the right there's text.

21 A Okay.

22 Q Okay. That column on the right, at the  
23 top it says, "ABC One-Hour Cleaners always used PCE  
24 in its dry cleaning operations beginning during 1953  
25 when the business opened.

1 "Hoff (phonetic) and" --

2 (Whereupon, there was an  
3 interruption.)

4 (Whereupon, the court reporter  
5 requests clarification.)

6 BY MS. O'LEARY:

7 Q Yeah.

8 "...when the business opened.

9 "Hoff and Higley PA (phonetic) deposition  
10 of Victor John Milts (phonetic) written  
11 communication April 12, 2001.

12 "A primary pathway of contaminants from  
13 drive cleaning operations at ABC One-Hour Cleaners  
14 to the soil and subsequently to groundwater was  
15 apparently through a septic tank soil absorption  
16 system to which ABC One-Hour Cleaners discharged  
17 waste and wastewater."

18 And it says, "Shriver 1985 reported that  
19 an inspection of the PCE storage area at ABC  
20 One-Hour Cleaners indicated that PCE releases could  
21 and did enter the septic system through a floor  
22 drain probably as a result of spillage in the  
23 storage area."

24 That's Roy F. Weston Inc. 1994. In  
25 addition -- F. Weston, Inc., 1994.



1 "In addition, spent PCE was routinely  
2 reclaimed using a filtration distillation process  
3 that produced dry still bottoms which, until about  
4 1982" -- I'm going to skip the parenthetical -- "or  
5 1984 and 1985, were disposed of on site generally by  
6 filling potholes in a nearby alleyway."

7 So do you agree that on this cat- -- this  
8 description in chapter F, the septic soil -- tank  
9 soil absorption system around ABC Cleaners was a  
10 primary pathway of contaminants from the dry  
11 cleaning operations?

12 A Yeah. Probably. Yes.

13 Q Okay. And are you aware based on -- you  
14 know, does it follow from what this paragraph said  
15 that ATSDR knew that ABC One-Hour Cleaners still  
16 waste was disposed of outside until 1982 or 1984 or  
17 1985?

18 A In terms of location that doesn't make  
19 any difference for us.

20 Q But that -- that -- that is what ATSDR  
21 knew about disposal practices; correct?

22 A It seems so, yeah.

23 MR. DEAN: Objection to form.

24 BY MS. O'LEARY:

25 Q Okay. If the -- does the time when ABC

1     Cleaners stopped disposing of their solid still  
2     waste outside affect how the model performs in terms  
3     of accuracy?

4             So what I mean is if -- you know, if the  
5     ABC Cleaners stopped disposing of their solid still  
6     waste in potholes in 1982, would that be expected to  
7     reduce modeled contaminant concentrations?

8             MR. DEAN: Object -- object to the  
9             form.

10            A     If you are referring to how we model the  
11     discharge from the ABC Cleaners, we looked at two  
12     different applications. One of them discharging at  
13     a point in the saturated zone --

14     BY MS. O'LEARY:

15            Q     Uh-huh.

16            A     -- that's the MT3DMS model --

17            Q     Uh-huh.

18            A     -- application. The other one is the  
19     discharging of the ABC Cleaners contaminants in  
20     the -- in the unsaturated zones of the aquifer.  
21     That's the TechFlowMP model.

22             So we looked at two different cases but  
23     both of them on a large scale map in a idealization  
24     that we have used is just a point.

25            Q     Okay. And so that's one point. Is that

1 on the boundary of one of the 50 by 50-foot, like,  
2 squares --

3 A Yeah.

4 Q -- in the mesh?

5 A Yeah.

6 Q Okay. I have a question about the  
7 calibration process for mass loading at --

8 A Okay.

9 Q -- Tarawa Terrace.

10 So this is on page -- to start on page  
11 F30 of chapter F, which is Exhibit 9.

12 A Okay.

13 Okay.

14 Q All right. So there's text underneath  
15 the figure on that page.

16 Do you see that?

17 A F11?

18 Q No, I'm sorry.

19 F30.

20 A Yeah. F30, yeah.

21 Q F30. Okay.

22 So the text at the bottom of that page --

23 A Yeah.

24 Q -- in the column on the right-hand side  
25 near, sort of, the middle there's a sentence that

1 begins, "The initial mass loading rate."

2 Do you see that?

3 A Yes.

4 Q Okay. It says, "The initial mass loading  
5 rate applied to the model was 230 grams per day and  
6 was adjusted upward during model calibration. The  
7 final calibrated mass loading rate was 1200 grams  
8 per day."

9 And I was wondering why did you start  
10 with 230 grams per day?

11 A I think it was estimated the volume of  
12 discharge from a cleaner operation.

13 Q Like, an average cleaner operation or --

14 A No. Beginning operation -- beginning  
15 value for a calibration application.

16 Q Specific to a dry cleaner?

17 A Yeah.

18 Q Okay. And how did you end up at  
19 1200 grams per day?

20 A Oh, we -- calibration means that. You  
21 adjust the parameter values to match the field data.  
22 So to get to the field data we observed in water  
23 treatment plant we had to increase the mass loading  
24 rates to that level.

25 Q Okay. And staying in chapter F, if you

1 can just go back to page F28?

2 A Okay.

3 Q And there's a section in the column on  
4 the right that's got the heading "Biodegradation."

5 Do you see that?

6 A F23, did you say?

7 Q F28?

8 A Twenty-eight.

9 Yes. Yes.

10 Q So under, "Biodegradation," it says,  
11 "Reductions of PCE concentration reported at water  
12 supply well TT-26 between September 1985 and  
13 July 1991, table F2, probably occurred largely by  
14 microbial mediated degradation such as reductive  
15 dechlorination."

16 And does that mean that biodegradation is  
17 called biodegradation because it involves microbes  
18 in the processes?

19 A Yes.

20 Q Okay. And does biodegradation rates of  
21 PCE depend on anything?

22 What I mean is, is the biodegradation  
23 rate of PCE always the same?

24 A Probably changes by temperature.

25 Q Okay. Would it vary by what microbes are

1 in the environment where the PCE is?

2 A I think biodegradation, referred to here,  
3 is the biodegradation of the chemical itself.

4 Q Right. Of -- of like --

5 A Right.

6 Q -- PCE into --

7 A Right.

8 Q -- TCE and on?

9 A Right.

10 Q Yeah. So -- so my questions are about  
11 the rate that that happens.

12 A Uh-huh.

13 Q So, you know, you mentioned temperature  
14 might affect that rate.

15 A Right.

16 Q What else would affect the biodegradation  
17 rate of PCE?

18 A Microbes are used sometimes to treat the  
19 contaminants. So my understanding is that the  
20 microbes in the aquifer affects the concentration  
21 values that is out there.

22 Q That's my last question on that area for  
23 a minute. Moving onto some questions about other  
24 parameters that were input into the Tarawa Terrace  
25 model.

1 First, what is bulk density?

2 A That's the dry density of soil.

3 Q Okay. And is bulk density used to  
4 calculate a retardation factor for a -- a particular  
5 chemical?

6 A That's correct.

7 Q If bulk density were calculated  
8 incorrectly, would that affect a calculation for a  
9 retardation factor?

10 A Yes, it does.

11 Q And if a bulk density value were  
12 calculated too high, would that cause a retardation  
13 factor to be higher or lower?

14 A If you are not changing any other  
15 parameter in that equation, it will be higher.

16 Q Okay. So they would vary together, bulk  
17 density and retardation factor?

18 A Yeah.

19 Q Okay.

20 A But there are other parameters in that  
21 equation.

22 Q Sure. Sure.

23 A Okay.

24 Q And then what is a distribu- --  
25 distribution coefficient or KD?

1           A       Okay. That describes the amount of soil  
2 that may be absorbed or -- a contaminant that may be  
3 absorbed on the soil system.

4           Q       Ah. So it would be removed from a  
5 plume --

6           A       Right.

7           Q       -- by the soil?

8           A       That's right.

9           Q       Okay. And is it calculated by the  
10 fraction of organic carbon multiplied by an organic  
11 carbon water partition coefficient?

12          A       That's correct.

13          Q       So is fraction organic common -- carbon,  
14 excuse me, often called FOC?

15          A       Yes.

16          Q       And is the organic carbon water partition  
17 coefficient often called KOC?

18          A       That's correct.

19          Q       And is distribution coefficient often  
20 called KD?

21          A       That's correct.

22          Q       If bulk density were calculated  
23 incorrectly, would that have an impact on KD?

24          A       No.

25          Q       No. Okay.



1                   If FOC were determined incorrectly, would  
2     that impact KD?

3           A       Yes, of course.

4           Q       Because it's multiplied by that --

5           A       Right.

6           Q       -- partition coefficient?

7           A       Right.

8           Q       And we'll stay in chapter F, I think  
9     right where -- around where we were.

10                   Can you go to page F27, that goes to page  
11     F28?

12          A       Yes.

13          Q       All right. In the column on the right,  
14     the last paragraph starts, "Estimates of retardation  
15     factors."

16                   Do you see that?

17          A       Yes.

18          Q       Okay. It says, "Estimates of retardation  
19     factors and distribution coefficients for PCE  
20     migration within the Tarawa Terrace aquifer or  
21     Castle Hayne aquifer are unknown, and initial  
22     estimates applied to the MT3DMS model were based on  
23     literature sources. Roberts, et al., 1986 reported  
24     retardation factors determined from a field scale  
25     investigation of PCE migration through a sand

1 aquifer that ranged from 2.7 to 5.9 based on the  
2 collection of high resolution synoptic data during a  
3 period of about two years.

4 "Retardation factors increased directly  
5 with increasing time but at a decreasing rate.  
6 Hoffmann, 1995, reported highly controlled  
7 laboratory column determination of distribution  
8 coefficients for PCE migration through gravels,  
9 sands, and silt.

10 "Of the approximately 150 samples  
11 analyzed the distribution coefficients for sand  
12 ranged from 0.25 to 0.76 milliliters per gram, and  
13 averaged 0.39 milliliter per gram. Corresponding  
14 values for silts ranged from 0.21 to 0.71  
15 milliliters per gram and averaged 0.4 milliliters  
16 per gram.

17 And it goes on to say that, "Neither the  
18 field scale experiments reported by Roberts, et al.,  
19 1986, know that -- nor the laboratory results of  
20 Hoffmann 1995 related to Camp Lejeune or even to  
21 North Carolina, the solute investigated in both  
22 studies was PCE. And PCE migration was observed  
23 through porous media of sands and silt -- sand and  
24 sands and silts similar to Camp Lejeune."

25 Did I read that correctly?

1 A Yeah.

2 Q Okay. So am I understanding correctly  
3 that the ATSDR had determined estimates of KD,  
4 distribution coefficients and retardation factors  
5 within the Tarawa Terrace aquifer and Castle Hayne  
6 aquifers, were unknown?

7 A Yeah. That the -- from what -- what you  
8 just have read, I think it's coming from  
9 literature -- literature data.

10 Q Okay. So in -- in calibrating the  
11 ATSDR's Tarawa Terrace model, did ATSDR select an  
12 initial KD value from the literature values that  
13 were reported?

14 A That's what it seems, yes.

15 Q Okay. And --

16 A But there's also data on KD at the site,  
17 as far as I recall.

18 Q Is it KD or FOC data at the site?

19 A I don't recall completely but I think it  
20 was KD.

21 Q Okay. So from what we read on F27 to 28,  
22 the literature range ATSDR reported for KD averaged  
23 0.39 milliliters per gram with a range of 0.25 to  
24 0.76 milliliters per gram for sands.

25 Right?

1 A Uh-huh. Yeah.

2 Q And for silts, it was an average 0.4  
3 milliliters per gram and a range of 0.21 to 0.71  
4 milliliters per gram.

5 A Uh-huh.

6 Q Okay. And that literature range was from  
7 laboratory experiments on sands or silts but not  
8 related to Camp Lejeune or North Carolina.

9 A That's right.

10 Q Okay.

11 A That's right.

12 Q And after calibration, am I correct that  
13 the ATSDR selected 0.14 milliliters per gram as the  
14 KD for the Tarawa Terrace calibrated model?

15 MR. DEAN: Object to the form.

16 A Well, that seems to be the number that --  
17 where -- where did you get that number? I don't --  
18 BY MS. O'LEARY:

19 Q It wasn't in that part but I thought you  
20 might know that. That the --

21 A No. Not on the top of my head, no.

22 Q Okay. Would you agree that 0.14  
23 milliliters per gram is lower than ten literature  
24 ranges ATSDR reported for both sands and silts?

25 A Uh-huh.

1 MR. DEAN: Object to form.

2 BY MS. O'LEARY:

3 Q For calculating KD, you had agreed that  
4 that was done by multiplying the fraction of organic  
5 carbon by that --

6 A Yes.

7 Q -- partition coefficient, KOC; is that  
8 right?

9 A Yes.

10 Q The KOC, the organic carbon water  
11 partition coefficient, is that compound specific or  
12 different for PCE than TCE?

13 A It's compound specific --

14 Q Yes.

15 A -- of course.

16 Q Of course. Okay.

17 And is --

18 A Yeah.

19 (Whereupon, the court reporter  
20 requests clarification.)

21 BY MS. O'LEARY:

22 Q Sorry.

23 Are values for the organic carbon water  
24 partition coefficient for each chemical available in  
25 literature?

1 A Yeah.

2 Q Okay. You said that you had read Alex  
3 Spiliotopoulos's report.

4 Did I hear you correctly?

5 A Yes.

6 Q And I -- I believe he included tables  
7 with fraction of organic carbon measurements from  
8 Camp Lejeune.

9 A Yes.

10 Q Do you know why the ATSDR didn't use  
11 those FOC estimates?

12 MR. DEAN: Object to the form.

13 A I don't know.

14 BY MS. O'LEARY:

15 Q Like, did -- did the ATSDR use those  
16 fraction organic carbon estimates when they were  
17 calculating KD for Tarawa Terrace?

18 A I don't know what they have done to come  
19 up with these retardation coefficients. But if that  
20 was available, I'm sure they have used it.

21 Q Okay. Do you -- if the fraction organic  
22 carbon data from Camp Lejeune were buried  
23 significantly --

24 A It -- it will -- it will vary by soil  
25 type, definitely.

1 Q Okay. Would that -- if it varies, would  
2 that be a reason not to use it to calculate the --

3 A I wouldn't know --

4 Q -- KD?

5 A -- why they have not used it if they have  
6 not used it.

7 Q But if you had fraction organic carbon  
8 data that varied a lot, would that cause you not to  
9 use it in determining a KD?

10 MR. DEAN: Object to the form of the  
11 question.

12 A It's -- it's a judgment call. If -- if  
13 you know enough information on what is at the site,  
14 it may be better to use it.

15 BY MS. O'LEARY:

16 Q Okay. And this -- I think you mentioned  
17 this phrase but I just wanted to check my  
18 understanding of what it is.

19 So you mentioned retardation factor, I  
20 believe?

21 A Yes.

22 Q What is a retardation factor?

23 A Due to absorption of chemicals in a soil,  
24 it acts as if -- a reduction factor of the velocity  
25 of the contaminants in the aquifer.

1           Q       A reduction in velo- -- velocity relative  
2 to what?

3           A       To the retardation coefficient of one.

4           Q       Is that for water, the "one"?

5           A       No, it's not a water issue.

6                   It's -- it's a issue of density. It's a  
7 function of distribution coefficient and the  
8 porosity.

9           Q       Okay.

10          A       You may ignore retardation factor --

11          Q       Uh-huh.

12          A       -- or you may calculate it as ATSDR has  
13 done.

14          Q       And if you calculate it, then that's  
15 going to be a retardation factor specific to a  
16 compound?

17          A       The distribution coefficient is specific  
18 to a compound --

19          Q       And --

20          A       -- because KOC is a --

21          Q       Right.

22          A       -- specific to a compound.

23          Q       And so -- and -- and distribution  
24 coefficient is used in calculating the retardation  
25 factor though; correct?



1 A Can you speak --

2 Q Yeah.

3 A -- louder, please?

4 Q A distribution coefficient is used in  
5 calculating a retardation factor; correct?

6 A That's correct.

7 Q Okay. So a particular calculated  
8 retardation factor is going to be specific to a  
9 compound; correct?

10 A That's correct.

11 Q Okay. And as K- -- KD, distribution  
12 coefficient, increases, what happens to retardation  
13 factor?

14 A All the other parameters kept constant --

15 Q Right.

16 A -- retardation increases.

17 Q Okay. And as retardation factor  
18 increases, does that mean the contaminant is moving  
19 more slowly relative to the groundwater flow --

20 A Yes --

21 Q -- speed?

22 A -- that's correct.

23 Q Okay.

24 MS. O'LEARY: And I want to,  
25 actually, turn to -- actually, this would

1 actually be a good place to stop.

2 MS. BOLTON: Yeah.

3 MS. O'LEARY: Do we know if lunch  
4 has arrived?

5 MS. BOLTON: I think it's here.

6 MS. BAUGHMAN: It's here.

7 MS. O'LEARY: Then we'll take a  
8 break now.

9 Thank you.

10 THE WITNESS: Okay. Thank you.

11 THE VIDEOGRAPHER: The time right  
12 now is 12:18 p.m. We are off the record.  
13 (Whereupon, there was a recess taken  
14 from 12:18 p.m. to 1:00 p.m.)

15 THE VIDEOGRAPHER: The time right  
16 now is 1:00 p.m. We are back on the  
17 record.

18 MS. O'LEARY: Thank you.

19 BY MS. O'LEARY:

20 Q And Professor Aral, if you could pull  
21 back up Government Exhibit 9, the chapter F  
22 report --

23 A Uh-huh.

24 Q -- for Tarawa Terrace and then go to page  
25 F28?

1 A Uh-huh.

2 Q And in the column on the left, the first  
3 paragraph, the bottom of that paragraph, it says,  
4 "An initial distribution coefficient."

5 Do you see that?

6 A Yeah.

7 Q Okay. So it says, "An initial  
8 distribution coefficient of 0.4 milliliters per gram  
9 or 0.000014 cubic feet per gram was applied  
10 uniformly to all layers of MT3DMS model for all  
11 stress periods. The final calibrated value was 0.14  
12 milliliters per gram" -- skipping the parenthetical  
13 -- "similarly applied and the calibrated retardation  
14 factor was 2.9."

15 So Professor Aral, having seen now that  
16 page, do you agree that in the calibrated model for  
17 the Tarawa Terrace, the -- the distribution  
18 coefficient was 0.14 milliliters per gram?

19 MR. DEAN: Objection to the form.

20 A The retardation coefficient was 2.9.

21 BY MS. O'LEARY:

22 Q Right. But do you agree the distribution  
23 coefficient was the 0.14 milliliters per gram?

24 MR. DEAN: Same objection.

25 A Yeah, but I don't recall that number. It

1 depends on whether it was a number related to the  
2 corrected density or earlier density, which was  
3 used.

4 BY MS. O'LEARY:

5 Q What do you mean "corrected density"?

6 A Well, in MT3DMS, I think there was a  
7 problem which was recognized in terms of density  
8 values, what density was not used and the other wet  
9 density was used. So it was corrected.

10 So I don't recall this number. If this  
11 is the corrected value, it must be correct.

12 Q And who corrected the bulk density  
13 value in --

14 A Bob Faye.

15 Q -- in MT3DMS?

16 A Bob Faye.

17 Q Bob Faye.

18 And where would you expect a record of  
19 that correction on bulk density to be in the  
20 reports?

21 A Was I aware of that?

22 MR. DEAN: Object to the form.

23 It's not in the report --

24 A Was I aware of that or how would I know  
25 that or --

1 BY MS. O'LEARY:

2 Q Well, you said that --

3 A What's the question?

4 Q Yeah. You said that Bob Faye --

5 A Uh-huh.

6 Q -- caught the bulk density error.

7 A Uh-huh.

8 Q And I asked where you would expect the  
9 fact that Bob Faye corrected bulk density to be in  
10 the ATSDR reports?

11 MR. DEAN: Object to the form. It's  
12 not in the reports.

13 A Bob density -- Bob Faye corrected the  
14 bulk density value and adjusted the distribution  
15 coefficient to the observations that he has in his  
16 hand, and the result came out to be the same  
17 retardation coefficient that you are reporting here.

18 BY MS. O'LEARY:

19 Q Retardation coefficient or distribution  
20 coefficient?

21 A Retardation coefficient.

22 Q Do you mean retardation factor?

23 MR. DEAN: Objection to the form.

24 A Retardation factor. It's the same  
25 terminology.

1 BY MS. O'LEARY:

2 Q So do you have any reason to think that  
3 what's listed in the chapter F report as the final  
4 calibration value for distribution coefficient -- so  
5 0.14 milliliters per gram --

6 A I assume --

7 Q -- is wrong?

8 A -- this -- this -- I have assumed this is  
9 the correct number.

10 Q The zero -- 0.14 milliliters --

11 A Yeah.

12 Q -- per gram?

13 Okay.

14 A Yeah.

15 MR. DEAN: Object to the form. The  
16 report --

17 MS. O'LEARY: And --

18 MR. DEAN: -- is dated  
19 February 2008.

20 MS. O'LEARY: And I'd like to  
21 move -- this will be number 40,  
22 supplement six from the Hadnot Point  
23 reports.

24 It looks like this will be  
25 Government Exhibit 11.

1 THE WITNESS: Okay.

2 (Whereupon, Government's Exhibit Aral  
3 11, Supplement Six from the Hadnot  
4 Point Reports, was marked for  
5 identification.)

6 THE WITNESS: Thank you.

7 MR. DEAN: Thank you.

8 BY MS. O'LEARY:

9 Q And Professor Aral, I'd like to go to  
10 page S6.14, so 14.

11 A Say that number again, please?

12 Q Yeah. S6.14. It will be on the  
13 bottom --

14 A Of which page?

15 Q -- left of the page.

16 A Okay.

17 Q Yeah. The page numbers start S6 on all  
18 of them.

19 A Yeah. One, four.

20 Yeah.

21 Q Okay. So there's a section labeled  
22 "Sorption." Under that it says, "Sorption in the  
23 HP, HB study area is assumed to be similar to  
24 sorption in the TT study area of USMCB Camp Lejeune  
25 described in Faye 2008."

1 "Sorption processes, i.e. adsorption and  
2 absorption for HPIA and HPLF models were represented  
3 in MT3DMS by using a linear isotherm sorption model.  
4 The input data required to simulate sorption  
5 included porosity, distribution coefficient, and  
6 soil bulk density. Constant values were assigned to  
7 the aforementioned model parameters throughout the  
8 model owing to the lack of site-specific field data.  
9 MT3DMS uses values assigned to porosity,  
10 distribution coefficient, and soil bulk density to  
11 compute a retardation factor."

12 And then we'll stop there.

13 So Processor Aral, do you agree that data  
14 sorption in MT3DMS -- or excuse me. Let me back  
15 that up.

16 Do you agree that MT3DMS was used in both  
17 Tarawa Terrace and Hadnot Point/Holcomb Boulevard  
18 water models?

19 A Can you repeat that --

20 Q Yeah.

21 A -- question louder, please.

22 Q Was --

23 MS. BAUGHMAN: Actually, if you  
24 don't mind, I meant to put something on  
25 the record about that.



1                   We -- we talked to Dr. Aral at the  
2                   break about the fact that he can't hear  
3                   you. And he's guessing at what you are  
4                   asking him often because he feels he  
5                   doesn't feel comfortable continuously  
6                   asking you to raise your voice.

7                   So you are risking having a record  
8                   that is not reliable and I'm -- I'm --  
9                   I'm putting you on notice right now: If  
10                  you don't raise your voice, he can't hear  
11                  you. He doesn't feel comfortable  
12                  continuously asking you so you need to  
13                  raise your voice.

14                  You are not -- when we ask you to  
15                  raise your voice, you are just repeating  
16                  the question and not making it louder.

17 BY MS. O'LEARY:

18                  Q           Professor Aral, are you uncomfortable  
19                  asking me to speak more loudly?

20                  A           Yes, I am.

21                  Q           Okay. Why?

22                  A           Because I'm a person of certain values  
23                  and standards. I cannot keep asking the same  
24                  question to the person I'm talking to.

25                  I expect that person to respond to my

1 question in the first time that they hear the  
2 question.

3 Q Well, if you can't understand me, please  
4 ask me to speak louder.

5 A Well, you may say that but I have a  
6 personality that doesn't allow me to do that.

7 Q So --

8 MS. BAUGHMAN: So our request is  
9 that you continuously raise your voice.

10 BY MS. O'LEARY:

11 Q Professor Aral, do you agree that the  
12 MT3DMS was used in both the Tarawa Terrace and  
13 Hadnot Point/Holcomb Boulevard water models?

14 A That's correct.

15 Q And do you agree that MT3DMS uses input  
16 values related to porosity, distribution  
17 coefficient, and soil bulk density?

18 A Yeah.

19 Q And do you agree, based on what it says  
20 here on page S6.14, that the ATSDR concluded that  
21 sorption in the Hadnot Point/Holcomb Boulevard study  
22 area was similar to sorption in the Tarawa Terrace  
23 study area?

24 A That's what it says.

25 Q And do you agree that MT3DMS is a model

1 that is trying to simulate sorption?

2 A I have not used MT3DMS lately so I don't  
3 remember the details of the input parameters on it.

4 Q I mean, the input parameters of porosity,  
5 distribution coefficient, and soil bulk density  
6 are -- are in what we just --

7 A Yeah. But --

8 Q -- read.

9 A -- you are talking about sorption.

10 Q Right.

11 A You asked that.

12 Q But those input parameters relate to  
13 sorption, don't they?

14 A Adsorption and sorption is the same  
15 thing? I don't think so.

16 Q Well, what is the difference?  
17 Aren't they both two examples of  
18 sorption?

19 A No, it's not.

20 Q How are they different?

21 A One of it is absorption into the soil --

22 Q Uh-huh.

23 A -- particles, the other one is  
24 absorption -- sorption onto the surface of soil  
25 particles. There's a big difference.

1 Q Okay. But for -- does MT3DMS model both?

2 A That's what I said, I have not used  
3 MT3DMS lately. So if there's a distinction between  
4 adsorption and sorption --

5 Q Uh-huh.

6 A -- whether it addresses that, I don't  
7 remember that.

8 Q But what does that have to do with  
9 porosity or distribution coefficients or soil bulk  
10 density and whether those would be similar at Tarawa  
11 Terrace and Hadnot Point --

12 A That's correct.

13 Q -- Holcomb Boulevard?

14 A But those refer to retardation  
15 coefficient evaluation, not sorption.

16 Q Isn't the retardation factor trying to be  
17 a way to account for --

18 A It --

19 Q -- sorption?

20 A No. It accounts for adsorption.

21 Q Right.

22 A Uh-huh.

23 Q Okay. Did you -- why would -- or, sorry.  
24 Going on -- still on page S6.14 at the  
25 top of the column on the right --

1           A       Okay.

2           Q       -- it says, "Typically, KD values are  
3       calculated based on laboratory scale experimental  
4       data that quantify partitioning behavior for a  
5       chemical in simple systems, e.g. octanol water in  
6       field data are estimates, for the amount of organic  
7       material present in the soil or aquifer material of  
8       interest.

9                   "Model specific KD values for benzene,  
10       0.11 liter per kilogram; TCE 0.15 liters per  
11       kilogram; and PCE, 0.3 liters per kilogram were  
12       derived by using partitioning data for each  
13       chemical. An assumed value of 0.002 for the site  
14       specific organic carbon fraction of aquifer material  
15       and refinement during the model calibration process.  
16       Final model-specific KD values are well within the  
17       range of values calculated for multiple sources of  
18       partitioning data."

19                   So do you agree that in the calibrated  
20       model for Hadnot Point, the ATSDR used 0.3 liters  
21       per kilogram for PCE?

22           A       This is what this report indicates.  
23       That's --

24           Q       Do you have any --

25           A       -- correct.

1 Q -- reason to think that's incorrect?

2 I'm sorry, I -- I interrupted you. What  
3 were you saying?

4 A Do I have any -- do I have any reason to  
5 believe that these numbers are incorrect?

6 Q Are not what the ATSDR used in the Hadnot  
7 Point model.

8 A Well, they -- they say that they have  
9 used it. I haven't written this report so they must  
10 have used it.

11 Q Okay. Is 0.3 liters per kilogram  
12 equivalent to 0.3 milliliters per gram?

13 A I have no idea.

14 Q You don't know?

15 A No, not on the top of my head. I need a  
16 calculator, maybe a computer to do -- to evaluate  
17 that.

18 Q Aren't there one thousand milliliters in  
19 a liter and one thousand grams in a kilogram?

20 A I'm so tired. I can't do that off the  
21 top of my head.

22 Q Okay. And do you know why the ATSDR  
23 decided to use a different distribution coefficient  
24 in Hadnot Point than what they had used in Tarawa  
25 Terrace, even though they had said they assumed

1 similar sorption?

2 MR. DEAN: Object to form.

3 A Again, you are using sorption instead of  
4 adsorption.

5 BY MS. O'LEARY:

6 Q Uh-huh.

7 A Sorption is a different process.

8 I don't know what you are referring to in  
9 terms of KD values referring to sorption.

10 Q Well, why did the ATSDR mention in this  
11 section on sorption --

12 A I --

13 Q -- and KD values that they felt the  
14 sorption in the two study areas was similar?

15 A I have not written this report so I will  
16 not be able to answer that.

17 Q Okay. Can we go back to the Tarawa  
18 Terrace chapter A report which is Government Exhibit  
19 3 and go to page A41.

20 (Whereupon, there was a discussion  
21 off the record.)

22 BY MS. O'LEARY:

23 Q Okay. Were you involved in the analysis  
24 of degradation by-products in the Tarawa Terrace  
25 model?

1           A       Yes. I was involved in the use of  
2       TechFlowMP model in degradation by-products.

3           Q       Okay. In page A41, in the column on the  
4       right near the top -- this actually starts the  
5       fourth line from the top -- there's a sentence that  
6       says, "The biodegradation rate was determined from  
7       field data and the calibration process."

8                   Do you see that?

9           A       Yeah.

10          Q       Does that match your understanding of how  
11       the biodegradation rate was determined in Tarawa  
12       Terrace?

13          A       It was a calibration parameter,  
14       definitely. Probably we have started with some  
15       initial values that we expected to see in the soils  
16       of Camp Lejeune as a generic database.

17                   So that's the starting point.

18          Q       What do you mean from a "generic  
19       database"?

20          A       Well, for example, there's a  
21       characterization of the aquifers in the Camp  
22       Lejeune. Different soil types has different values  
23       for these parameters. Probably we used those soil  
24       types to come up with the generic values that we  
25       started with, then calibration parameter takes



1 precedence and adjusts itself.

2 Q When you say "generic values," do you  
3 mean from measurements at the site or from, like,  
4 literature reference values?

5 A Its says here "biodegradation rate was  
6 determined from field data." So there must be some  
7 field data that we have used in that.

8 Q That would mean from Camp Lejeune?

9 A Yeah.

10 Q Okay. And --

11 A That's what I understand.

12 Q And then if you could go to the Tarawa  
13 Terrace chapter F report, which is Government  
14 Exhibit 9, and to page F28?

15 A Yes.

16 Q And there's a column on the right, and it  
17 says, "Biodegradation."

18 Do you see that?

19 That -- there's a label in the column on  
20 the right --

21 A Uh-huh.

22 Q -- that says, "Biodegradation." And then  
23 there are some, like, values listed. And I want  
24 to turn --

25 A Can you show me on that?

1 Q Yeah.

2 A Oh.

3 Q So here's biodegradation and then can you  
4 look at --

5 A What did you say, F20 or F28?

6 Q F28.

7 A Okay.

8 Yeah. Okay.

9 Q Okay. So in that biodegradation section,  
10 the -- the last paragraph.

11 A Yeah.

12 Q Okay. So there it says, "The PCE  
13 concentrations at water supply well TT-26 on  
14 September 25, 1985, and July 11, 1991, were 1100 and  
15 350 micrograms per liter, respectively. And the  
16 elapsed time was 2,151 days. Applying these data to  
17 equation three yields a degradation rate of 0.00053  
18 per day."

19 Do you see that section?

20 A Uh-huh.

21 Q Okay. And so trying to relate what we  
22 just read in this chapter F to what we just saw in  
23 chapter A about field data for biodegradation rate,  
24 am I understanding then that these measurements at  
25 TT-26, the September 25th, 1985 and July 11th, 1991,

1 those are the field data where ATSDR started with to  
2 calculate biodegradation rate?

3 A Probably, yeah.

4 Q Okay. Do you see anything in here  
5 describing a calibration process where that was  
6 refined?

7 MR. DEAN: Object to the form.

8 A In reference to this?

9 BY MS. O'LEARY:

10 Q To the biodegradation rate.

11 A In reference to the MT3DMS application or  
12 TechFlowMP application?

13 Q Well, as I look at chapter F, page F28, I  
14 don't see any dis- -- reference to whether it's  
15 MT3DMS or TechFlowMP or both.

16 A Yes --

17 Q It's just saying --

18 A -- exactly. But this report that you are  
19 showing me, chapter F, is PCE analysis coming from  
20 MT3DMS.

21 Q Uh-huh.

22 A You started your questioning by asking me  
23 biodegradation rates of TechFlowMP, now you are  
24 showing me chapter F --

25 Q Yeah.

1           A       -- again, which is MT3DMS analysis.

2                   Are you asking me whether we have used  
3 these numbers in TechFlowMP, or what is the question  
4 here?

5           Q       I mean, that is an eventual question,  
6 yes. Did you --

7           A       Okay.

8           Q       -- use the same --

9           A       Can you repeat that question to me now?

10          Q       Did you also use degradation rate of  
11 0.00053 per day in TechFlowMP?

12          A       That --

13                   MR. DEAN: Object to the form.

14          A       -- that could be the starting point but  
15 it's a calibration parameter, altogether.

16 BY MS. O'LEARY:

17          Q       Was that the value in the calibrated  
18 model of TechFlowMP?

19          A       I remember biodegradation rates.  
20 Probably it was, yes.

21          Q       Okay.

22          A       Probably. I'm not sure.

23          Q       And still on page F28, going -- is it --  
24 it spans F28 to F29.

25          A       Okay.

1           Q       So after the sentence I already read, it  
2       says, "Potentiometric levels shown in figures F7  
3       and F8 indicate that while TT-26 is located on a  
4       direct advective pathway from ABC One-Hour Cleaners.  
5       This PCE mass migrates down gradient toward and away  
6       from well TT-26. To the extent that migration of  
7       PCE mass toward and away from well TT-26 occurred at  
8       about equal rates from 1985 to 1991, the computed  
9       degradation rate of 0.00053 per day approximates a  
10      long term average degradation rate. On the other  
11      hand, if a significant quantity of the PCE degraded  
12      in the vicinity of well TT-26 was replaced by  
13      advection, then the degradation rate computed using  
14      equation three is probably a minimum rate."

15                   Do you agree?

16                   MR. DEAN: Object to the form.

17           A       This --

18                   MR. DEAN: Does he agree -- hold on  
19                   a second.

20                   Object to the form. We agree you  
21                   read the paragraph correctly but you  
22                   continue to read to him a -- a report  
23                   that he did not participate in --

24                   MS. O'LEARY: Yeah.

25                   THE WITNESS: Right.

1 MS. O'LEARY: No, I under-

2 MR. DEAN: -- nor did he author.

3 MS. O'LEARY: I understand that.

4 BY MS. O'LEARY:

5 Q My question is, do you agree with what  
6 this report says that that biodegradation rate --

7 A This report --

8 Q -- would repre- -- would represent a  
9 minimum rate if -- if --

10 MR. DEAN: Objection.

11 BY MS. O'LEARY:

12 Q -- travel to and from TT-26 aren't the  
13 same?

14 MR. DEAN: Object to form.

15 A This report talks about what they have  
16 done or Bob Faye has done --

17 BY MS. O'LEARY:

18 Q Okay.

19 A -- on application of MT3DMS.

20 Q Right.

21 A I don't know anything about that. I  
22 wasn't a part of that modeling. I didn't write this  
23 report.

24 I'm on the record for that.

25 Q I understand that, Professor Aral. You

1 did, however, do the TechFlowMP --

2 A That's correct.

3 Q -- analysis and that also involved a  
4 biodegradation rate --

5 A That's correct.

6 Q -- correct?

7 And you said you think you did use the  
8 same biodegradation rate.

9 MR. DEAN: Object to form.

10 A I said it was a calibration parameter, as  
11 far as I recollect.

12 BY MS. O'LEARY:

13 Q Well, what value did you use at  
14 TechFlowMP?

15 A It must be in our reports. I --

16 Q Okay.

17 A -- don't have it here --

18 Q Right.

19 A -- on the top of my mind.

20 Q So --

21 A Yeah.

22 Q -- would you agree with the concept  
23 that's described in what I just read about flow --

24 A I --

25 Q -- towards and away from TT-26

1 affecting --

2 A I --

3 Q -- whether this biodegradation --

4 A I'm going to --

5 Q -- rate --

6 MR. DEAN: Objection to form.

7 MS. O'LEARY: Excuse me, can I  
8 finish my question?

9 MR. DEAN: Sure.

10 BY MS. O'LEARY:

11 Q -- whether that bio- --

12 MS. BAUGHMAN: Dr. Aral, make sure  
13 you let her finish the question before  
14 you answer, okay?

15 THE WITNESS: Yeah.

16 BY MS. O'LEARY:

17 Q Okay. So to rephrase, do you agree that  
18 flow towards and away from TT-26 is not about the  
19 same for -- for PCE and its degradation products,  
20 then the calculation that was apparently used to  
21 come up with 0.00053 would likely represent a  
22 minimum rate of biodegradation at TT-26?

23 MR. DEAN: Object to form.

24 A I -- I -- you know, you are making  
25 statements, like minimum or maximum, without any



1 value -- evaluation of what it is, okay?

2 I will not answer that question whether  
3 it was a minimum for this application. It could  
4 have been a different value for the TechFlow --  
5 TechFlowMP application. So I cannot answer  
6 questions related to another chapter and refer my  
7 answers to a chapter which is written by me on  
8 TechFlowMP.

9 BY MS. O'LEARY:

10 Q Yeah.

11 A So these two models are totally  
12 different.

13 Q No, I -- I under- --

14 A You cannot -- you cannot compare the  
15 values used, the initial values used, whether it was  
16 a calibration outcome at the end or not. Those are  
17 totally different questions.

18 If you ask me what TechFlowMP does, how  
19 does it do it, I'm ready to answer it. But I'm not  
20 going to answer somebody else's report, somebody  
21 else's model right now.

22 Q So my question is not about MT3DMS and  
23 it's not --

24 A But you started with that.

25 Q This is in a chapter about that but

1 that's not my question, right?

2 A Okay.

3 Q My question is about the science  
4 expressed in this sentence, right?

5 This is not about what MT3D- -- -DMS  
6 does. It's a statement about how actual movement  
7 would affect biodegradation rate measurement  
8 calculation. That's not MT3DMS. It's about inputs  
9 that go into both MT3DMS and TechFlow.

10 So my question is: Do you agree with the  
11 scientific statement here about how different rates  
12 traveling of contaminants towards and away from  
13 TT-26 would impact whether the way this describes  
14 calculating a biodegradation rate is accurate?

15 MR. DEAN: Object to the form.

16 A The moment of contaminants from A to B  
17 doesn't imply or doesn't involve the calculation of  
18 biodegradation rates. The --

19 BY MS. O'LEARY:

20 Q Sure.

21 A -- biodegradation rates starts the  
22 calculation. The calculation ends up with the  
23 moment of the contaminants in the aquifer based on  
24 that input data, not vice versa. The flow doesn't  
25 determine the biodegradation rates.

1                   Your question is totally out of  
2       scientific base.

3           Q       Why?

4           A       I explained to you. You are saying  
5       moment of contaminants in the aquifer determines the  
6       biodegradation rate. I'm saying --

7           Q       No, that's not what I'm saying.

8                   MR. DEAN: Object to the form.

9                   Please let him finish his answer.

10                  THE WITNESS: Okay.

11                  MS. O'LEARY: Go ahead.

12           A       That's what I understood.

13                   And then you are saying the  
14       biodegradation rates are determined based on the  
15       flow. That's not correct.

16       BY MS. O'LEARY:

17           Q       No. What this says on page --

18           A       Can you repeat what --

19           Q       -- on F28 --

20           A       -- it says?

21           Q       Yeah.

22                   What it says on F28 --

23           A       Yeah.

24           Q       -- is that, "Potentiometric levels  
25       shown on figures F7 and F8" --

1 A Uh-huh.

2 Q -- "indicate that while TT-26 is located  
3 on a direct advective pathway from ABC One-Hour  
4 Cleaners" --

5 A Yeah.

6 Q -- "thus PCE mass migrates downgradient  
7 toward and away from well TT-26. To the extent that  
8 migration of PCE mass toward and away from well  
9 TT-26 occurred at about equal rates from 1985 to  
10 1991, the computed degradation rate of 0.00053 per  
11 day approximates a long term average degradation  
12 rate."

13 Do you agree with that?

14 MR. DEAN: I'm going to object to  
15 the form of the question. I'm going to  
16 instruct the witness -- no, I'm not.

17 You've asked the same question now  
18 five times. You are getting to the point  
19 of badgering the witness, okay?

20 MS. O'LEARY: Excuse me.

21 MR. DEAN: No.

22 MS. O'LEARY: Let me continue.

23 MR. DEAN: No. No. We are not --

24 MS. O'LEARY: No. You are limited  
25 to form and foun- and foundation. Let's

1 continue.

2 MR. DEAN: No. But I'm going to  
3 protect the witness from -- from you  
4 harassing him. You are reading to him a  
5 report he had nothing to do with and you  
6 know that --

7 MS. O'LEARY: Mister --

8 MR. DEAN: -- and he's already told  
9 you --

10 MS. O'LEARY: Mr. Dean, let's  
11 continue --

12 MR. DEAN: Let me finish. Let me  
13 finish.

14 MS. O'LEARY: Let's go off the  
15 record and we can talk for a few minutes.

16 MR. DEAN: No, we don't -- I don't  
17 want it off the record. I want this on  
18 the record --

19 MS. O'LEARY: Let's go off the  
20 record.

21 MR. DEAN: -- so the Court can  
22 read --

23 MS. O'LEARY: Thank you.

24 MS. BAUGHMAN: We are not agree to  
25 go off the record.

1 MR. DEAN: I want the Court to read  
2 it.

3 MS. O'LEARY: Well, then please stop  
4 interrupting.

5 MR. DEAN: I'm not interrupting.

6 BY MS. O'LEARY:

7 Q So Professor Aral, did you understand  
8 when I reread?

9 My question is do you agree --

10 MR. DEAN: Asked and answered. Move  
11 on.

12 MS. O'LEARY: No.

13 BY MS. O'LEARY:

14 Q Do you agree?

15 A Repeat the question --

16 Q Yeah.

17 A -- please?

18 MR. DEAN: It's the same question  
19 she's asked five, six -- eight times now.

20 MS. O'LEARY: Evidently, he's not  
21 clear on what it is, so --

22 BY MS. O'LEARY:

23 Q Figures F7 and F8 indicate that, "While  
24 TT-26 is located on a direct advective pathway from  
25 ABC One-Hour Cleaners" --

1 (Whereupon, the court reporter  
2 requests clarification.)

3 BY MS. O'LEARY:

4 Q Okay.

5 -- "thus PCE" --

6 MS. BAUGHMAN: And you need to speak  
7 louder.

8 BY MS. O'LEARY:

9 Q -- "thus PCE mass migrates downgradient  
10 toward and away from well TT-26."

11 A That's correct.

12 Q "To the extent that migration of PCE mass  
13 toward and away from well TT-26 occurred at about  
14 equal rates from 1995 to 1991, the computed  
15 degradation rate of 0.00053 per day approximates a  
16 long-term average degradation rate."

17 Do you agree with that?

18 MR. DEAN: Object to the form --

19 A See the --

20 MR. DEAN: -- of the question.

21 A -- the point that I don't agree is that  
22 computed biodegradation rate statement written in  
23 that report is not correct..

24 Biodegradation rate was evaluated  
25 first -- I mean, that reads like the water

1     contaminant moment determines, somehow, the  
2     biodegradation rates. The computed -- computed  
3     refers to the modeling computation.

4             If it refers to the computed  
5     biodegradation rate first as database and that  
6     database being used in the model results in that  
7     contaminant plume, that's a correct answer.

8             But that computed implies to me that the  
9     biodegradation rate was computed based on what the  
10    model results predicted.

11   BY MS. O'LEARY:

12         Q       What if it --

13         A       That --

14             MS. BAUGHMAN: Wait.

15         A       -- I don't understand.

16   BY MS. O'LEARY:

17         Q       Okay. What if it's referring to the two  
18    measurements at TT-26?

19             MR. DEAN: Object to --

20   BY MS. O'LEARY:

21         Q       -- in the two points in time. So we are  
22    talking about September 1985 and July 1991.

23             If that's what the computed means, then  
24    do you agree?

25             MR. DEAN: Object to the form of the



1           yes. You are asking him to speculate on  
2           a report he did not prepare what that  
3           intended sentence means.

4           A       Okay. If the -- if the computed  
5       biodegradation rate that was reported in a chapter F  
6       report, that I have no contribution to, is used in  
7       the MT3DMS model which resulted in the migration of  
8       the contaminants from ABC Cleaners towards the TT-26  
9       plumping route, that's the correct definition.  
10      That's correct. I agree with that.

11      BY MS. O'LEARY:

12           Q       Okay. So would you agree then that on  
13      the other hand, if a significant quantity of the PCE  
14      degraded in the vicinity of well TT-26 was replaced  
15      by advection, then that degradation rate computed,  
16      using equation three which is on F28, is probably a  
17      minimum rate?

18                   MR. DEAN: Object to the form of the  
19                   question.

20           A       What does -- what does advection got to  
21      do with the biodegradation rate? Can you tell me  
22      that?

23      BY MS. O'LEARY:

24           Q       Isn't it talking about how fast the  
25      different PCE and its by-products are moving --

1 A But --

2 Q -- up and downstream?

3 A But your statements are not  
4 scientifically correct. Please correct your  
5 question so that I can answer properly.

6 Q What doesn't make sense in my question?

7 A You are associating advection in an  
8 aquifer --

9 Q Uh-huh.

10 A -- with biodegradation rate. It has  
11 nothing to do with that.

12 Q I'm not trying to associate  
13 biodegradation with an advection rate. I'm trying  
14 to talk about the effect of two data points that  
15 were used for calculating a biodegradation point.  
16 Do you appreciate the difference?

17 A That is a totally different application  
18 of the equation three that we have seen in this  
19 report.

20 If you are trying to calibrate a  
21 biodegradation rate based on some observed  
22 contaminant migration, not simulation --

23 Q Right.

24 A -- then that's fine.

25 Q Okay. So that is what I mean. Not a

1 simulation --

2 A Okay.

3 Q -- I mean calculation from observed data.

4 A Yeah. But where is that observed data  
5 coming from?

6 Q Well, it -- it says here in chapter F  
7 that there were measurements in September 1985 --

8 A Okay.

9 Q -- and --

10 A So there's --

11 Q -- "Jaloo" 1991 --

12 A -- field study --

13 Q Right.

14 A -- which looked at -- so your question  
15 were not complete for me to answer that.

16 So let's start with the beginning. They  
17 have made -- ATSDR has made field studies --

18 Q Uh-huh.

19 A -- is that correct?

20 I mean, I'm not --

21 Q Well, there --

22 A -- supposed to start this discussion  
23 but --

24 Q They are -- they are reporting the two  
25 values; right?

1                   They are reporting September --

2           A       Is that --

3           Q       -- 25, 1985 --

4           A       -- field study?

5           Q       It is what ATSDR is reporting from the  
6 field.

7           A       So you don't know what --

8                   MR. DEAN: Object to the form.

9           A       -- the chapter F is saying --

10                  MR. DEAN: Mischaracterizes --

11          A       -- I don't know what chapter F is saying,  
12 so why are we discussing this?

13 BY MS. O'LEARY:

14          Q       Well, I wanted to see if you agreed with  
15 the scientific conclusion they made based on what  
16 they reported on data.

17          A       If there's an independent field study  
18 that ATSDR has conducted to determine the  
19 biodegradation rate, independent of MT3DMS --

20          Q       Sure.

21          A       -- simulations, I accept that.

22          Q       Okay. So then do you similarly accept  
23 what the ATSDR says about if, on the other hand, a  
24 significant quantity of the PCE degraded in the  
25 vicinity of well TT-26 was replaced by advection,

1 then the degradation rate computed using equation  
2 three is probably a minimum rate?

3 MR. DEAN: Objection to the form of  
4 the question. Asked and answered 50  
5 times.

6 A I -- I have no idea who wrote -- I mean,  
7 I know who wrote this report. I didn't write it so  
8 I have no idea what this is all about.

9 BY MS. O'LEARY:

10 Q Okay. And do you agree that if you have  
11 a higher biodegradation rate, that means PCE is  
12 going to degrade into TCE, and on, at a faster rate?

13 A Right.

14 Q Do you agree that a higher biodegradation  
15 rate used in the -- either MT3DMS or TechFlowMP  
16 would result in lower PCE concentrations at TT-26?

17 A As far as I know, MT3DMS application look  
18 at -- looked into single species model.

19 Q I agree.

20 A Okay. So why are we referring to MT3DMS  
21 in this question?

22 Q Because my question is just about how a  
23 higher biodegradation rate would affect PCE  
24 concentrations at TC -- at TT-26?

25 A It will reduce -- it will be reduced

1 compared to non-biodegraded -- -degraded PCE  
2 concentrations.

3 Q Would it be reduced compared to a --  
4 using a lower biodegradation rate or would it be  
5 increased?

6 A If you change the parameters of a model,  
7 results will change.

8 Q Yeah. So if you put in a higher  
9 biodegradation rate --

10 A Yeah.

11 Q -- are you going to get lower PCE  
12 concentrations --

13 A That's correct.

14 Q -- at TT-26?

15 A That's correct.

16 Q And do you agree that lower PCE  
17 concentrations at TT-26 would result in lower PCE  
18 concentrations entering the Tarawa Terrace Water  
19 Treatment Plant?

20 A TT-26 is the main supplier of the  
21 contaminants, so if it is lowered, water treatment  
22 entry values will be lowered.

23 Q Okay.

24 MS. O'LEARY: Can we pull 28?

25 Actually, nevermind. We'll skip

1                   that.

2       BY MS. O'LEARY:

3           Q       When you were doing the TechFlowMP model,  
4       did you run it using other biodegradation rates  
5       besides the 0.00053?

6           A       In different applications we have used  
7       many different parameters.

8           Q       I mean in the Tarawa Terrace model.

9           A       We have used what we have reported.

10          Q       Okay. Thank --

11          A       I don't remember that number out of my  
12       mind.

13                   MS. O'LEARY: Then can we get 20- --

14          A       Besides, remember that it's a calibration  
15       parameter.

16       BY MS. O'LEARY:

17          Q       Uh-huh.

18                   MS. BAUGHMAN: What exhibit number  
19       is this?

20                   MS. O'LEARY: This is Exhibit 12.  
21       (Whereupon, Government's Exhibit Aral  
22       12, E-mail Chain, was marked for  
23       identification.)

24       BY MS. O'LEARY:

25          Q       Okay. So Professor Aral, I'm handing you

1 Exhibit 12. It appears to be an e-mail -- a chain  
2 of e-mails.

3 I'd like to start at the one that starts  
4 in the middle of the first page where it says, "From  
5 Morris Maslia."

6 Do you see that?

7 A Yeah.

8 Q Okay. As you look at the part of this  
9 thread that starts at the second half of 12 at --  
10 from Morris Maslia and continues onto the second  
11 page --

12 A Uh-huh.

13 Q It says, To Jason Sauntner (phonetic),  
14 Renee Sorresoto (phonetic), Amy Krueger (phonetic),  
15 to -- and e-mails, one of which is  
16 Mustafa.Aral@ce.gatech.edu?

17 A Uh-huh.

18 Q Is that your e-mail address?

19 A Yes.

20 Q And do you recall receiving this e-mail?

21 A Yes.

22 Q Okay. And did you discuss this e-mail  
23 with Morris Maslia ever?

24 A Discuss?

25 Q Yes.



1 A Yes.

2 Q Okay. Did you ever discuss it with  
3 Robert Faye, Rob Faye?

4 A Uh-huh. Oh, did I --

5 Q Did you discuss this --

6 A No.

7 Q No? Other than Morris Maslia, have you  
8 disc- -- did you ever discuss this e-mail with  
9 anyone else during the --

10 A No.

11 Q -- water modeling?

12 A No.

13 Q Okay. And the e-mail says in the first  
14 paragraph, "In this particular case, there is  
15 apparently a discrepancy on the value of the  
16 biodegradation rate for PCE 0.006 per day and 0.004  
17 per day."

18 A Uh-huh.

19 Q And do you recall that discrepancy in  
20 biodegradation rate for PCE?

21 A This wasn't a discrepancy. This was a  
22 factual -- fact finding. We are using two different  
23 models.

24 Q Uh-huh.

25 A One is MT3DMS model and the other one is

1 using TechFlowMP model.

2 It is normal to two different models  
3 calibrate to two different constants which is  
4 differing from one another in the order of 0.0001  
5 per day.

6 Q Uh-huh.

7 A And then the issue becomes the leader of  
8 the group, which is Morris Maslia --

9 Q Uh-huh.

10 A -- who wants to go with a uniform  
11 constant to be used in both models. And since these  
12 two numbers are not significantly different --

13 Q Uh-huh.

14 A -- from another, he made that decision  
15 that a mid-value should be used and I agreed with  
16 that.

17 I'm sure what -- I'm sure Bob Faye agreed  
18 with that as well.

19 Q Okay. So then in the e-mail, the -- in  
20 the numbered list number one says, "Fate and  
21 transport results provided using the MT3DMS model,  
22 we'll use a biodegradation rate of 0.0005 per day."

23 Do you agree that is what happened?

24 A Which one are you referring to?

25 MR. DEAN: He's read- -- she's

1 reading number one.

2 A Okay. Number one.

3 BY MS. O'LEARY:

4 Q Yeah.

5 A MT3DMS, I think it's using -- see, one  
6 number is -- ends with a four, the other one with a  
7 six, so the average was five. Could that be a --

8 Q No, my question is just: Is 0.0005 what  
9 was used in --

10 A Yeah.

11 Q -- MT3DMS?

12 A At the end, yes.

13 Q Okay.

14 A Of course.

15 Q And is that what was used in TechFlowMP  
16 as well?

17 A Exactly.

18 Q Okay. And if we are back in the first  
19 paragraph --

20 A Uh-huh.

21 Q -- of the part from Morris Maslia?

22 A Yeah.

23 Q So the part that begins the middle of  
24 page --

25 A Right.

1 Q -- one.

2 I think it's the second sentence says,  
3 "In this particular case, there is" -- excuse me,  
4 the sentence after that.

5 "There are two different levels of  
6 sophistication of models used, MT3DMS versus  
7 TechFlowMP" -- that's what you just --

8 A Exactly.

9 Q -- said basically; right?

10 A Yeah.

11 Q "And a lack of definitive data to compare  
12 modeling results attack -- against non-detects  
13 ranging from 2-micrograms per liter to 10 micrograms  
14 per liter in my opinion do not constitute a  
15 definitive standard by which to compare modeling  
16 results."

17 Do you agree that there was no definitive  
18 data on biodegradation rate?

19 MR. DEAN: Object to the form.

20 A I think that was a calibration parameter.  
21 That's what I said at the beginning.

22 BY MS. O'LEARY:

23 Q Does that --

24 A Even if we started with a certain  
25 estimate of a beginning point, it changes based on

1 calibration --

2 Q Okay.

3 A -- that we are doing.

4 Q Does that mean you would agree there was  
5 no definitive data on the biodegradation rate?

6 MR. DEAN: Object to the form of the  
7 question.

8 A As far as I know, whether there is field  
9 data existing or not, I cannot remember it right  
10 now --

11 BY MS. O'LEARY:

12 Q Okay.

13 A -- but probably not.

14 Q And then in the e-mail, at number  
15 three --

16 A Number three.

17 Q Yeah.

18 Actually, excuse me, number four.

19 Number four is, "If you wish to compare  
20 simulated results with measured samples including  
21 ND, you can do so in a table with four columns:  
22 sample location, date, measured value, simulated  
23 value detection limit. You are free to discuss in  
24 the text any implications you see from the data, but  
25 no other quantitative analyses are to be made. I'm

1 abandoning the use of the geometric bias as I have  
2 concluded we just do not have the data to justify  
3 its use."

4 And then right after it, it says, "Each  
5 report analysis will also provide a graphical  
6 comparison such -- such as the one I'm attaching as  
7 an example. I'm providing both tiff and jpeg file  
8 formats. In your respective graphs, you can plot  
9 simulated PCE versus time for a specific condition,  
10 e.g., calibrated early arrival, late arrival, etc.,  
11 and overlay that with the measured data only."

12 A Uh-huh.

13 Q And what did you understand as the  
14 directions that Morris Maslia was giving in this  
15 e-mail bout not making quantitative comparisons  
16 using non-detects?

17 A I -- I will think from five, first of  
18 all, he's giving instructions to his team as to use  
19 a plot to --

20 Q Uh-huh.

21 A -- generate a plot to see how the two  
22 results are comparing with each other.

23 In terms of number four, what was your  
24 question in reference to that?

25 Q What were the directions --

1 A What direction --

2 Q -- you were receiving from this about  
3 using no quantitative comparisons with non-detects?

4 A I think he -- Morris is referring to some  
5 graphical analysis of the results with or without  
6 detects.

7 Other than that, I don't remember the  
8 content of this number four.

9 Q Okay. Did you understand number five in  
10 this list as prohibiting graphical displays that  
11 overlaid simulated --

12 A Yeah.

13 Q -- concentrations using different  
14 biodegradation rates?

15 A Right. He's asking different  
16 biodegradation rates and plotting the results to --

17 Q Wasn't he --

18 A -- compare.

19 Q Isn't he saying everyone is using 0.0005  
20 as their biodegradation rate?

21 A No, before it gets to that stage --

22 Q Right.

23 A -- I think he was suggesting that his  
24 team to look into this.

25 Q How -- how is he suggesting that?

1           A       He's suggesting to abandon -- abandon the  
2       other way of comparing the results, which is the --  
3       I don't remember what that is now -- the -- some  
4       graphical geometric bias representation.

5                    So he's suggesting to check the graphical  
6       comparison of simulated --

7           Q       Uh-huh.

8           A       -- results in chapter -- in item five and  
9       asks to see that comparison.

10          Q       Right. So in five, the second sentence  
11       where it says, "In your respective graphs, you can  
12       plot simulated PCE versus time for a specific  
13       condition, e.g., calibrated early arrival, late  
14       arrival, etc." --

15          A       Uh-huh.

16          Q       -- "and overlay that with the measured  
17       data only."

18          A       Yeah.

19          Q       So does that mean you couldn't overlay  
20       that with, for example, data from runs of the  
21       simulation with --

22          A       I --

23          Q       -- two different --

24          A       I --

25          Q       -- biodegradation rates?



1           A           I wouldn't answer that question because  
2           you are referring to what Morris has said in his  
3           position of the leader of this group and you are  
4           expecting me to interpret that. I wouldn't answer  
5           that question.

6           Q           Did you make any graphical displays in  
7           reports you authored where you showed results of two  
8           different biodegradation rates --

9           A           No.

10          Q           -- in the simulated model?

11          A           Even if we did, it didn't appear in a  
12          report. We may have looked at it.

13          Q           Okay. And when you started calibrating  
14          the TechFlowMP model, did you start with the  
15          calibrated mass loading rate from MT3DMS, what they  
16          had used in that?

17          A           Yeah, starting point was the same.

18          Q           And did you use that starting point in  
19          both the unsaturated and saturated zones of  
20          TechFlow?

21          A           We discharged that into the unsaturated  
22          zone, looked at the volatilization effects.

23          Q           Uh-huh.

24          A           We also considered the soil  
25          concentrations and the dilution from the soil

1 concentrations.

2 Q Uh-huh.

3 A That was available data for us, so that  
4 brought us to the starting point --

5 Q Uh-huh.

6 A -- of the calibration. So two -- two  
7 processes are different.

8 Q Sure. And when you started calibrating  
9 TechFlowMP, did you start with the biodegradation  
10 rate that had come from the calibration of the  
11 MT3DMS --

12 A Probably --

13 Q -- model?

14 A -- as a starting point, yes.

15 Q Sure. And how did the biodegradation  
16 rate change as you calibrated TechFlowMP?

17 A It must be in the tables that we have  
18 written in the reports.

19 Q Okay.

20 A I don't remember now.

21 Q You don't remember?

22 A Yeah.

23 Q Is biodegradation in the saturated zone  
24 anaerobically driven?

25 A Yeah.

1           Q       Is biodegradation in the unsaturated zone  
2 aerobically driven?

3           A       That's correct.

4           Q       Okay. How do they compare? Is anaerobic  
5 biodegradation, for example, bigger or smaller than  
6 aerobic?

7           A       Aerobic will be bigger --

8           Q       And --

9           A       -- volatilization.

10          Q       Oh, I wanted to ask just specifically  
11 about biodegradation.

12          A       Biodegradation.

13          Q       So not losses, but -- but just  
14 biodegradation.

15          A       Okay.

16          Q       Is anaerobic -- anaerobically-driven or  
17 aerobically-driven biodegradation faster?

18          A       You cannot say "driven" because it  
19 depends on the length of the unsaturated zone --

20          Q       Uh-huh.

21          A       -- and then the saturated zone. The --  
22 this is a time-dependent process.

23                 How long does it stay in the unsaturated  
24 zone is the driver actually. If you put a  
25 contaminant in the unsaturated zone, it passes

1 through in --

2 Q Uh-huh.

3 A -- seconds. It will be a different  
4 driving mechanism than if it stays there for days,  
5 months, etc. --

6 Q Right.

7 A -- because of the lower rates of  
8 migration. Of course that will be a different  
9 driver.

10 Q But what if it was in the two zones for  
11 the same amount of time? So if we were comparing  
12 apples to apples --

13 A Uh-huh.

14 Q -- if we were looking at the same amount  
15 of time in saturated and the same amount of time in  
16 unsaturated, and so we're looking at aerobically and  
17 anaerobically driven?

18 A Yeah.

19 Q Which one is faster?

20 A You are trying to speculate -- me to  
21 speculate on that. I --

22 Q But I'm wondering if you know?

23 A No, I'm not going to answer that because  
24 I have to run it and see it.

25 Q So you don't know, like, reference --

1 A No.

2 Q -- scale?

3 A I don't have a reference in my mind.

4 MS. O'LEARY: Okay. Can we look at  
5 27, please?

6 (Whereupon, there was a discussion  
7 off the record.)

8 MS. BAUGHMAN: He means by that, be  
9 careful to let her finish her question  
10 before you answer.

11 COURT REPORTER: And the answer  
12 finish. There's a lot of overlap.

13 MS. O'LEARY: Yeah. You know what,  
14 we're actually not going to talk about  
15 27.

16 BY MS. O'LEARY:

17 Q So moving on, I have questions --

18 THE WITNESS: What is 27?

19 MS. O'LEARY: It's an e-mail. But  
20 I'm not going to ask you anything about  
21 it, so I'm not going to introduce it.

22 BY MS. O'LEARY:

23 Q So I have questions for you now about  
24 pumping schedules at Tarawa Terrace, and I have just  
25 some questions for you about the -- the way water

1 supply wells work and are maintained.

2 So if I say where a well is screened, do  
3 you understand what I'm talking about?

4 A Uh-huh.

5 Q What is where a well is screened mean to  
6 you?

7 A That's where the water enters into the  
8 well hole.

9 Q Okay. And are you familiar with the  
10 concept of crusting on a screen from mineral  
11 deposits?

12 A It may happen, yes.

13 Q Okay. Does that cause blocking then of  
14 the screen?

15 A The capacity of the well reduces by that.

16 Q Is that, like, just phys- -- you know,  
17 basic physics? You get blocks --

18 A It's not physics.

19 Q -- from the minerals?

20 A It's a natural process.

21 Q Isn't everything physics in basis?

22 A Not really.

23 Q Not really?

24 Do you -- are you familiar with issue  
25 with wells being -- blockage of the screen from the

1 growth of algae or bacteria?

2 A Yeah.

3 Q And what -- well, you've already answered  
4 for the mineral crusting.

5 You said that that reduces well capacity;  
6 is that right?

7 A Right.

8 Q Does blockage of a screen from algae or  
9 bacteria growth also lessen well capacity?

10 A Of course, yes.

11 Q And how -- is it possible to try and fix  
12 mineral crusting that has happened on a -- on a well  
13 screen?

14 A You mean reduce that well capacity  
15 reduction?

16 Q Well --

17 A What --

18 Q -- reduce the crusting to try and  
19 increase capacity?

20 A I don't think so. I mean, you can  
21 reflush the well just to flush out the accumulated  
22 amounts in there and then restart pumping.

23 Q Okay.

24 A That's a way of --

25 Q And is --

1           A       -- treating the problem.

2           Q       Okay. So you can treat the problem by,  
3 you said, flushing?

4           A       Yeah.

5           Q       Okay. Can you -- what if you are dealing  
6 with -- or can you in- -- inject with, like, an acid  
7 to try and remove a mineral crust?

8           A       That's not within my expertise --

9           Q       Okay.

10          A       -- area. That's a field study  
11 application.

12          Q       And what about, like, the algae or  
13 bac- -- bacteria that are blocking a screen, can you  
14 try and fix that?

15          A       That's also not in my expertise area.

16          Q       Okay. If -- for the flushing that you  
17 mentioned --

18          A       Yeah.

19          Q       -- how long does that take to do?

20          A       That's not in my expertise area.

21          Q       Okay. How are the pumps in -- in water  
22 supply wells, how are they cooled?

23          A       How are they what?

24          Q       Cooled?

25          A       Cooled?



1 Q Yeah. The pumps themselves?

2 A I have no idea. I mean, that's a field  
3 study.

4 Q Okay.

5 MS. O'LEARY: Can we pull  
6 number one, please?

7 (Whereupon, there was a discussion  
8 off the record.)

9 MS. O'LEARY: All right. This will  
10 be Government Exhibit 13, Professor Aral.

11 (Whereupon, Government's Exhibit Aral  
12 13, Excerpt from Expert Panel  
13 Transcript from March 28, 2005, was  
14 marked for identification.)

15 THE WITNESS: Uh-huh.

16 BY MS. O'LEARY:

17 Q And this is an excerpt from an expert  
18 panel transcript from March 28th, 2005.

19 Are you familiar with this expert panel?

20 A Yeah. I have attended some, too;  
21 probably most of them.

22 Q Okay. And this panel was reviewing water  
23 modeling efforts of ATSDR at Camp Lejeune; right?

24 A That's what it says, yeah.

25 Q Okay. So can you go to -- it will be

1 marked as page 140?

2 A What?

3 Q It should say 140 in the top right  
4 corner.

5 A I have three pages in mine.

6 Q But one of them should be 140?

7 A Oh, okay.

8 MS. BAUGHMAN: That --

9 A Yeah, okay.

10 MS. O'LEARY: Yeah.

11 A Yeah.

12 BY MS. O'LEARY:

13 Q Okay. So on that page, starting at  
14 line nine, there's something from Dr. Walski.

15 Do you know who Dr. Walski is?

16 A Yeah, I know him.

17 Q Was he a member of this expert panel?

18 A Yes.

19 Q Okay. And there's also -- it mentions a  
20 Mr. Faye.

21 Is that the same Bob Faye?

22 A I assume so, yeah.

23 Q Okay. So at line nine, it says  
24 Dr. Walski said, "The fraction -- the fraction of  
25 the time was 26 on. Is it run, like, 80 percent of

1 the time or did it run 70 percent of time on  
2 average?"

3 And Mr. Faye said, "That I really don't  
4 know, Tom. All I know that it probably rotated."

5 And Dr. Walski said, "Okay. So --"

6 And Mr. Faye said, "And so didn't run a  
7 hundred percent of the time."

8 And you -- you mentioned that you had  
9 been at this panel; is that correct?

10 A That doesn't mean that I understand what  
11 they are talking about.

12 Q Well, would you -- you don't know what  
13 they are talking about?

14 A No, I don't know what they are talking  
15 about.

16 Q So you don't know if they are talking  
17 about how much TT-26 was run?

18 A No idea.

19 Q Okay. I think we looked at this earlier,  
20 but do you agree that the ATSDR model showed TT-26  
21 as pumping unless there was a documented --  
22 documentation that it was out of service?

23 A You mean actually it was pumping at a  
24 lower rate or at a period that it was modeled in the  
25 contaminant transport model?

1           Q       I mean in the model, it was assumed to  
2 always be pumping, albeit at --

3           A       Yeah, yeah, yeah.

4           Q       -- varied amounts --

5           A       Yeah, yeah.

6           Q       -- unless it was documented that it  
7 wasn't pumping?

8           A       Yeah, I understand what you are referring  
9 to.

10                   Yes, the -- all the models -- all the  
11 pumping wells were assumed when they were running,  
12 pumping. Within a month --

13          Q       Uh-huh.

14          A       -- they were pumping throughout the  
15 month. If they are not -- if they are offline for  
16 three, four days --

17          Q       Uh-huh.

18          A       -- we didn't reflect that in the modeling  
19 analysis because we have a time period of one month  
20 sequentially to run one after the other.

21                   We cannot get into a time interval and  
22 adjust pumping conditions. That's not possible.

23          Q       Was it ever considered to try and  
24 reconstruct a maintenance schedule at the wells?

25          A       Do I have information on that?

1 Q Right.

2 A No, I don't.

3 Q Okay. Do you agree that assuming that  
4 TT-26 was pumping, unless documents showed it  
5 wasn't, was a con- -- a more conservative assumption  
6 than, for example, assuming that it had a  
7 maintenance schedule?

8 MR. DEAN: Objection. Form.

9 Assumes facts not in evidence.

10 MS. BAUGHMAN: Also, I think you  
11 need to speak louder. I don't think he's  
12 hearing you.

13 THE WITNESS: Yeah.

14 BY MS. O'LEARY:

15 Q Would you like me to repeat the question?

16 A Can you repeat the question, please?

17 Q Sure. Do you agree that assuming the  
18 TT-26 was pumping unless documents show that it  
19 wasn't was a more conservative assumption than  
20 modeling a maintenance schedule for TT-26?

21 A Conserv- --

22 MR. DEAN: Same objection.

23 A Conservative in what sense? Increased  
24 contaminant levels will be transferred to the water  
25 treatment plant --

1 BY MS. O'LEARY:

2 Q Right.

3 A -- is that what you are implying?

4 Q Right.

5 A Yes, that would be the case.

6 Q Okay. Okay. Can we go to chapter F  
7 again for a minute, ATSDR?

8 A I would like to be on record that I have  
9 not written this report, didn't run the simulations,  
10 and I'm not ready to answer the questions that may  
11 be coming up.

12 Q Okay. If we go -- I understand you did  
13 not write the chapter F.

14 If we go to page F 33 --

15 A Yes.

16 Q There's a table and then there's some  
17 text on the bottom right column. And in that text,  
18 it says -- kind of in the middle of the top  
19 paragraph, it says, "A geometric bias that  
20 compares."

21 Do you see that?

22 A Yeah.

23 Q Okay.

24 "A geometric bias that compares simulated  
25 and observed concentrations also was computed. An

1 inclusive bias was computed using all 19 paired data  
 2 at water supply wells and equaled 5.9. A selected  
 3 bias also was computed that excluded paired data at  
 4 water supply well TT-23 and equaled 3.9. Both  
 5 results indicate that simulated PCE concentrations  
 6 moderately to substantially over-predicted observed  
 7 concentrations at water supply wells."

8 So in reading that, do you understand  
 9 this to mean that ATSDR calculated geometric bias  
 10 for Tarawa Terrace in two ways, one that did not  
 11 include non- -- which did not include non-detects?

12 A Yes.

13 Q Is that correct?

14 MR. DEAN: Object -- object to form.

15 A Yes.

16 BY MS. O'LEARY:

17 Q And then it -- they -- in that  
 18 calculation of geometric bias for the Tarawa Terrace  
 19 model, they did it in two ways: one where they  
 20 included TT-23 and one where they did not?

21 A Uh-huh. Yes.

22 Q Do you know why the ATSDR calculated  
 23 geometric bias with and without water supply well  
 24 TT-23?

25 A Is it reported in this chapter F report,

1     that -- that statement?

2             Q       I --

3             A       Is it coming from this chapter?

4             Q       I mean, I think -- I think I just read  
5     it, that it said --

6                     MS. BAUGHMAN:  He can't hear you,  
7     that's why.

8                     MS. O'LEARY:  Yeah.

9             A       I -- I think you're looking at the  
10    different text than reading from the chapter.  
11    That's why I'm having problems.  You are not reading  
12    from the chapter.  You are reading from your notes.  
13    BY MS. O'LEARY:

14            Q       That's a snip of the same thing.

15            A       Yeah, but I don't know that.  It's --  
16    it's your choice.

17            Q       Right.  Do you have F 30- -- page F 33 in  
18    front of you?

19            A       Yeah, I do.

20            Q       Okay.  So in there, right, it says, "a  
21    selected bias also was computed that excluded paired  
22    data at water supply well TT-23"?

23            A       Yes.

24            Q       Okay.  So my question is:  Do you know  
25    why the ATSDR calculated a geometric bias with and



1 without TT-23?

2 A Probably the TC -- TT-23 was operating at  
3 a much shorter period of time. Whatever the data is  
4 coming from that, probably they don't want to  
5 include. I have no idea.

6 I think this report that you are  
7 referring to is not written by me. I have no idea  
8 what the -- the author wanted to say at that point  
9 in reference to these questions you are asking,  
10 so...

11 Q Okay. Do you agree that the Tarawa  
12 Terrace model moderately to substantially  
13 over-predicted observed concentrations at water  
14 supply wells?

15 A I think you should look at the results in  
16 an ensemble analysis of statistics rather than  
17 looking at point values of a well at a certain time,  
18 comparing it with the observations made at a certain  
19 time or at a similar time at the site.

20 So the analysis doesn't -- although  
21 ATSDR -- -DR provided all kinds of tables, the  
22 analysis was based on statistical analysis, not  
23 point-wise comparisons.

24 Q That statistical analysis is the  
25 geometric bias; right?

1           A       No, the statistical analysis is based on  
2       the uncertainty analysis, whether the model falls  
3       into that range, whether the application is  
4       consistent with that uncertainty range, whether the  
5       sensitivity analysis is associated with that  
6       parameter reflects that --

7           Q       Sure.

8           A       -- in the model.

9                   I mean, there are so many other aspects  
10      of uncertainty or statistical analysis rather than  
11      just looking at a scatter diagram that I am seeing  
12      here.

13          Q       I understand that.

14                   But isn't geometric bias part of that  
15      statistical --

16                   MR. DEAN:  Objection.

17          A       Not necessarily.

18                   MR. DEAN:  Hold on.  Hold on.

19      BY MS. O'LEARY:

20          Q       -- analysis?

21                   MR. DEAN:  Hold on.  Object to the  
22      form.  Asked and answered.

23                   MS. O'LEARY:  Well, it wasn't  
24      answered.

25

1 BY MS. O'LEARY:

2 Q Sorry, what were you saying  
3 Professor Aral?

4 MR. DEAN: He told you he couldn't  
5 answer it.

6 MS. O'LEARY: He did not say that.

7 A Okay. I said it in record. I said it --  
8 that.

9 I didn't write this report. I'm not  
10 answering any questions that is coming from somebody  
11 else's statements in this report.

12 BY MS. O'LEARY:

13 Q Yeah.

14 A And a scatter report -- a diagram like  
15 that may be used or may not be used. I'm not  
16 insisting that it should be used.

17 BY MS. O'LEARY:

18 Q So if we go to Exhibit 3, which is the  
19 chapter A report --

20 A Chapter A report. Okay.

21 Q -- to page 25?

22 A Page?

23 Q A 25.

24 A Okay.

25 Q Oh, actually, we can skip this. Never

1 mind. We don't have to go through that.

2 A Okay.

3 Q Okay. On -- back to chapter F page 33,  
4 so where we were.

5 A Okay. Chapter F.

6 Q Yeah, I want to talk to you --

7 A I repeat my on-the-record statement on  
8 that.

9 Q I just have questions about the data in  
10 this table. So Table F 13 --

11 A Page?

12 Page --

13 Q So we are on F 33.

14 A Okay. Okay.

15 Q So I just want to make sure I'm  
16 understanding the data in this table correctly.

17 A Uh-huh.

18 Q This is showing simulated -- so from the  
19 model -- PCE concentrations at water supply wells  
20 and then matching those up with observed  
21 concentrations of PCE in the water supply wells in  
22 Tarawa Terrace; is that correct?

23 A That's what it seems so.

24 Q Okay. And then it's showing in the  
25 column at the right, the calibration target range;

1 is that correct?

2 A Yeah.

3 Q So if I look at the section on TT-23, am  
4 I correct in -- in understanding this is showing  
5 that all 11 samples over-predicted PCE  
6 concentrations in the simulation versus the observed  
7 for TT-23?

8 A Repeat that question for --

9 Q Yeah.

10 A And loud, please?

11 Q For TT-23 in figure F 13 --

12 A Yes.

13 Q -- am I correct in understanding that the  
14 simulated PCE concentrations were higher for all 11  
15 of the TT-23 entries?

16 A Yes. They were all higher, but they were  
17 in the calibration range as well.

18 Q Well, for TT-23, actually, didn't ten of  
19 11 of them fail the calibration range?

20 A If I recall --

21 Q Not ten of 11, excuse me.

22 A I mean, the range goes from 11 to 117.

23 Q Yeah.

24 A Any way.

25 Q Okay.

1 A Yeah.

2 Q And if we look at TT-26 --

3 A Yes.

4 Q -- and am I correct that five  
5 over-predicted the PCE concentrations? Five of  
6 eight?

7 A Five zero eight?

8 Q Five of them were over- --

9 A Oh.

10 Q -- predictions of a total of eight; is  
11 that correct?

12 A Yeah.

13 Q And looks like several failed the  
14 calibration range --

15 MR. DEAN: Object.

16 BY MS. O'LEARY:

17 Q -- as well; is that correct?

18 MR. DEAN: Object to the form of the  
19 question.

20 A I -- I am on record saying that we don't  
21 look at calibration conditions based on one well at  
22 a time and compare the observed and the simulated  
23 values at one point in time. We look at the overall  
24 ensemble analysis --

25

1 BY MS. O'LEARY:

2 Q Yeah.

3 A -- of the statistics --

4 Q Yeah.

5 A -- of that representation.

6 So what you are doing right now is  
7 bringing back to me one data at a time comparison.

8 I would not do that.

9 Q But Professor Aral, I mean, you've  
10 already said -- agreed that -- earlier that this  
11 table is --

12 A That table is --

13 Q -- all of the values that were used --

14 A -- correct.

15 Q -- for calibration?

16 A That table is for you to look at and see  
17 the results.

18 Q Right.

19 A Analysis of the results is a total  
20 different story.

21 Q But --

22 A You do it statistically. You do it --

23 Q Yeah.

24 A -- in a different methodology.

25 Q Yeah. So this Table F 13, though, is --

1 is the comparison of all of the values --

2 A This is not --

3 Q -- used for calibration?

4 A It is not the comparison. It is for you  
5 to see what numbers are there. We are looking at or  
6 using in a statistical sense, probably they are  
7 going to refer to this table.

8 Q Uh-huh.

9 A These numbers or the statistics that we  
10 came up with is coming from this table. That's it.

11 Other than that, this table just for the  
12 information to be sent out to the other person to  
13 see what it is.

14 MS. O'LEARY: Can we go to 26?

15 A Page 26.

16 MR. DEAN: No.

17 BY MS. O'LEARY:

18 Q No, it's going to be a new exhibit.

19 A Okay.

20 Q You don't have it yet.

21 A Oh, okay.

22 Q That was for Ms. Horan to grab the right  
23 document?

24 A Okay.

25 (Whereupon, there was a discussion



1 off the record.)

2 MR. DEAN: Yeah, we should have put  
3 this on the record earlier. But when we  
4 are referring to an exhibit, the number  
5 we are using is the number we call out as  
6 the exhibit number in the deposition --

7 MS. O'LEARY: Yeah.

8 MR. DEAN: -- for the record.

9 MS. O'LEARY: Thank you.

10 (Whereupon, Government's Exhibit Aral  
11 14, E-mail from Mustafa Aral to  
12 Jerome Ensminger, was marked for  
13 identification.)

14 BY MS. O'LEARY:

15 Q And so I've just handed Professor Aral  
16 what's marked as Government Exhibit -- is it 14?

17 MS. HORAN: Yup.

18 MS. O'LEARY: And then for the  
19 record, this is not a Bates-stamped copy,  
20 but the Bates is CLJA\_ATSDR\_ --

21 (Whereupon, the court reporter  
22 requests clarification.)

23 BY MS. O'LEARY:

24 Q Yeah.

25 -- -A\_ATSDR\_BOVE-0000018710 and then the

1 next page is -- ends in -11?

2 MS. BOLTON: I hate to do this, but  
3 can you just repeat just the final  
4 numbers --

5 MS. O'LEARY: Just the numbers?

6 MS. BOLTON: Yeah.

7 MS. O'LEARY: -18710 to -11 -- you  
8 know, to -11.

9 MS. BOLTON: Okay.

10 MS. BAUGHMAN: There were five zeros  
11 first?

12 MS. O'LEARY: Yes.

13 Okay.

14 BY MS. O'LEARY:

15 Q And Professor Aral, this looks to be an  
16 e-mail from you to Jerome Ensminger; is that  
17 correct?

18 A That's correct.

19 Q Do you recall this e-mail?

20 A Yeah. No, it's coming from me,  
21 definitely.

22 Q Okay. So -- and the subject --

23 A Okay.

24 Q -- is --

25 A Yeah, I remember this.

1 Q You do? Okay.

2 A Yeah.

3 Q It says the subject is testimony from  
4 John Nuckholls?

5 Who --

6 A Yes, yes, yes.

7 Q Who is John Nuckholls?

8 A One of the members of the expert panel.

9 Q The expert panel for 2005 or for --

10 A I don't --

11 Q -- 2009?

12 A One of them. I'm not sure.

13 Q Okay. And who is --

14 A I -- I think he was on the NRC report  
15 panel? Or did we have a panel? I'm not sure.

16 Q Okay.

17 A Anyway, he was on the NRC report.

18 Q And who is Jerome Ensminger?

19 Who is Jerome Ensminger?

20 A I think one of the plaintiffs; right?

21 Yeah.

22 Q You think he's a plaintiff? Okay.

23 This e-mail, though, is from -- it looks  
24 like it's from October 6th, 2009.

25 Do you have any reason to think that date

1 is incorrect?

2 A The date on it is -- seems to be correct;  
3 yeah.

4 Q Okay. And -- in October of 2009, how did  
5 you know Jerome Ensminger?

6 A I met him in probably 2005 in one of the  
7 ATSDR meetings. I told you that --

8 Q Yeah.

9 A -- at the beginning.

10 Q And at the beginning here, the first  
11 line, it says, "After a quick read, the following  
12 points strike me as not coming clean in his overall  
13 testimony."

14 A Yes.

15 Q Whose testimony are you talking about?  
16 Is that John Nuckolls' testimony?

17 A I think so, yeah.

18 Q And what was he testifying about?

19 A I think the expert panel was suggesting  
20 that ATSDR should use simpler models rather than  
21 complex models --

22 Q Uh-huh.

23 A -- to finish up the project and don't  
24 spend too much time on calibration.

25 MR. DEAN: Why don't you take time

1                   and take a look at the e-mail.

2                   THE WITNESS: I -- I know this  
3                   e-mail.

4                   MR. DEAN: Okay.

5 BY MS. O'LEARY:

6           Q       Okay. So Professor Aral, I have a  
7           question for you on the paragraph that's numbered  
8           three.

9           A       Yeah.

10          Q       And it says, "His" -- I'm starting at  
11       the -- there's a line that says, "Having said that,"  
12       kind of in the middle; do you see that?

13       A       Yeah.

14       Q       Okay. It says, "Having said that, in  
15       historical reconstruction methodology verifications  
16       are made by extending the historical predictions to  
17       the present day timeframe to see if the model that  
18       predicts the past ties to the present day conditions  
19       smoothly.

20                    "In this verification process, the data  
21       used are the observed data in the present day. The  
22       verification in this case is the prediction of the  
23       present day with the use of the same model. This  
24       verification was done in the TT-modeling study and  
25       the results indicate that the models predicted the

1 past -- predicting the past was successfully  
2 predicting the present when extended to the present  
3 day within certain acceptable bounds of error."

4 And do you agree that in historical  
5 reconstruction methodology, verifications are made  
6 by -- can be made by extending the historical  
7 prediction to the present day timeframe to see if  
8 the model that predicts the past ties to the present  
9 day conditions smoothly?

10 A First of all, this modeling sequence that  
11 we are working with has four stages.

12 Q Uh-huh.

13 A Unstressed conditions in the ground  
14 waters, stressed conditions in the ground water.

15 For those two model applications, we have  
16 a lot of data. So those models are -- are  
17 calibrated, recalibrated looking at the data and so  
18 forth.

19 When we move to the third stage, which is  
20 the contaminant --

21 Q Uh-huh.

22 A -- transport model, there's no data,  
23 okay, at the field during the period of the  
24 historical --

25 Q Uh-huh.

1           A       -- reconstruction.

2                   However, having said that, if the first  
3       two models like stress/unstressed conditions in the  
4       aquifer is properly calibrated, most of the  
5       processes in the contaminant transport model is  
6       already available to us to run the model. Whether  
7       those -- those are advection conditions, diffusion  
8       conditions --

9           Q       Uh-huh.

10          A       -- it comes from the previous two models.

11          Q       Sure, sure.

12          A       In other words, if there's velocity, the  
13       velocity field is determined. If the velocity is  
14       determined, the diffusion constants are determined.

15                 So what is missing -- what is missing is  
16       the retardation coefficients that we would use that  
17       we have discussed earlier or biodegradation rates  
18       that we have used earlier.

19                 And I think there were several databases  
20       that was available to us towards the end of the  
21       period of the contaminant transport calibration. We  
22       have used that database. That's the 36 number that  
23       we were talking about. All of it was used to  
24       calibrate the contaminant transport analysis.

25                 And when we come to the final stage, the

1 models one, two, three --

2 Q Uh-huh.

3 A -- was verified using the water treatment  
4 plant database, which is the present day conditions  
5 that I'm referring there in that e-mail. And that  
6 was used to verify the model.

7 Q Okay. I just want to make sure I  
8 understand which present day conditions.

9 Present day contaminant concentrations  
10 or --

11 A Present day contaminant concentrations,  
12 which is coming from in an independent data set,  
13 which is the water treatment plant data set which  
14 occurred probably after 1987 -- I'm not sure  
15 exactly -- but went onto '89 or something like that.

16 Q So when was this -- I'm not understanding  
17 why it's called "present day" if it's the 1980s and  
18 this is from 2009.

19 A Oh, we are predicting -- making  
20 predictions until 1987 or '89. That's all we are  
21 doing. Present day means to us 1987 or '89, not  
22 when this --

23 Q Oh --

24 A We are not referring to this 2009.

25 Q Okay. So do you mean to the -- the



1 present day is like the time of calibration data?

2 A Exactly.

3 Q Okay. I understand. Thank you.

4 A Yeah.

5 There's a -- okay. Go ahead.

6 (Whereupon, there was a discussion  
7 off the record.)

8 MS. O'LEARY: Do we need to take a  
9 break?

10 THE VIDEOGRAPHER: No. No. It's  
11 just that you dropped it.

12 MS. O'LEARY: Oh. Thanks.

13 And I'd like to move onto -- this  
14 will be chapter H, which is 62.  
15 You can set aside 14.

16 (Whereupon, Government's Exhibit Aral  
17 15, Tarawa Terrace Chapter H Report,  
18 was marked for identification.)

19 THE WITNESS: No, I need the other  
20 one.

21 MS. O'LEARY: You're right.

22 BY MS. O'LEARY:

23 Q Okay. So Professor Aral, you have now  
24 what's Government Exhibit 15. It's a copy of the  
25 Tarawa Terrace chapter H report.

1                   Am I correct that you -- you did author  
2 this report?

3           A       Yes.

4           Q       All right. Can you go to page H 3?

5           A       Yes.

6           Q       And this is in a section called "A Review  
7 of ATSDR's Tarawa Terrace Study Background."

8                   And the column on the left, the -- the  
9 last paragraph, it starts saying, "Using  
10 hydrogeologic data."

11                   Do you see that?

12          A       Yes.

13          Q       Okay. Then about midway through that,  
14 there's a sentence that begins, "Due to."

15                   Do you see that?

16                   "Due to the nature"?

17          A       Yeah.

18          Q       Okay. So it says, "Due to the nature of  
19 historical reconstruction, uncertainties are  
20 associated with reconstructed information, which in  
21 turn cause uncertainties in resulting exposure  
22 analyses. Uncertainties in the exposure outcome can  
23 have a significant effect on the epidemiological  
24 study. In particular, the uncertainty caused by the  
25 groundwater pumping schedule used in the simulations

1 has been pointed out to be important. Therefore, in  
2 this study there's an evaluation of the variation in  
3 PCE concentrations and arrival times of the maximum  
4 contaminant level" -- skipping the parentheses --  
5 "at water supply wells and the water treatment  
6 plant. The variation could be caused by changes in  
7 groundwater pumping rates at water supply wells."

8 So a few questions about that.

9 First, do you still agree with that?

10 A Yes, I do.

11 Q Okay. And who was it who pointed out  
12 that uncertainty caused by the groundwater pumping  
13 schedule is important?

14 A Expert panel members.

15 Q And why did they say it was important?

16 A Because changes in pumping rates  
17 obviously is going to -- going to effect the arrival  
18 times of contaminants to pumping wells.

19 Q Why does changes in pumping rates cause  
20 change in contaminant arrival levels?

21 A Because the driver is the contaminant --  
22 pumping well rates for the plume migration.

23 Q Okay.

24 A If it changes, the plume will change.

25 Q Okay. And did you then do a study to

1 evaluate variation in PCE concentrations and the  
2 arrival times of MCLs at the water supply wells --  
3 (Whereupon, the court reporter  
4 requests clarification.)

5 BY MS. O'LEARY:

6 Q Agree -- did you do a study to evaluate  
7 variation in PCE concentrations and arrival times at  
8 the MCL at water supply wells and the water  
9 treatment plant at Tarawa Terrace?

10 A That's right.

11 Q Okay. And if you go -- still in -- at  
12 the same Exhibit 15, the chapter H report -- can you  
13 go to --

14 A Chapter A?

15 Q H.

16 No, the same -- the same one, H.

17 MR. DEAN: H.

18 A Okay.

19 BY MS. O'LEARY:

20 Q Page H 1?

21 A Page one?

22 Q Yup.

23 A Yes.

24 Q Okay. So this is in -- labeled the  
25 abstract?

1           A       Uh-huh.

2           Q       And in the column on the right, the  
3 paragraph that starts, "During the historical  
4 reconstruction study."

5                   It's kind of in the middle.

6                   It says, "A major cause for and  
7 contribution to this uncertainty are the pumping  
8 schedules which are discussed in other report  
9 chapters. The focus of this chapter report,  
10 therefore, is on the uncertainty associated with  
11 pumping schedules. The study discussed in this  
12 chapter includes the development of a simulation and  
13 optimization procedure identified as PS Ops" --

14                   Is that how you would say that?

15          A       Yeah.

16          Q       Yeah.

17                   -- "which combines simulation models and  
18 optimization techniques to optimize pumping  
19 schedules for maximum or minimum contaminant  
20 concentrations at the water treatment plant. Based  
21 on optimized pumping schedules, variations of PCE  
22 concentration and the maximum contaminant level  
23 arrival time at water supply wells and the water  
24 treatment plant are evaluated. Results of this  
25 study indicate that variation of pumping schedules

1 may cause significant changes in the contaminant  
2 concentration levels and MCL arrival times at the  
3 water treatment plant."

4 Do you agree that a major cause for and  
5 contribution to uncertainty is the pumping schedule  
6 in Tarawa Terrace?

7 MR. DEAN: Object to the form.

8 A We have identified that major statement  
9 later in the chapter showing the uncertain --  
10 uncertainty band --

11 BY MS. O'LEARY:

12 Q Uh-huh.

13 A -- changes when it is -- when the pumping  
14 schedules are optimized and different schedules are  
15 used in an application. So won't get stuck on that  
16 major word, just look at the statistics at the end.

17 Q And Professor Aral, we'll get there. I  
18 just -- do you disagree with what you wrote about  
19 the major --

20 A No, I don't --

21 Q -- cause --

22 A -- I don't disagree.

23 Q Okay. And PS Ops, I want to try and make  
24 sure I understand what it did.

25 So it does a simulation and optimization

1 for ranking the wells; is that correct?

2 A No, not ranking.

3 Q Well --

4 A It is -- it answers the following  
5 question quite clearly: How many different ways we  
6 can combine --

7 Q Uh-huh.

8 A -- all these pumping wells to meet the  
9 demand at Camp Lejeune site which will give us a  
10 totally different outcome than the mean --

11 Q Uh-huh.

12 A -- concentrations that we used to get  
13 with a fixed schedule.

14 Q Okay.

15 A That answers that question.

16 Q Yeah. And does it -- to do that, does it  
17 use a rank and assigned method to maximize or  
18 minimize or more optimize the arrival time of  
19 contaminants at water supply wells?

20 A It's -- it's emphasizing the arrival  
21 times. Is it going to come to the -- the  
22 contaminant is going to arrive --

23 Q Uh-huh.

24 A -- at a certain date earlier --

25 Q Sure.

1           A       -- than what was predicted.

2                    So it just combines all that -- those  
3       conditions in an optimization model.

4           Q       Right. And is the way it does that  
5       with --

6           A       Yeah.

7           Q       -- a rank and assignment of the wells?

8           A       Yeah, a rank and assignment is a solution  
9       process for an optimization --

10          Q       Okay.

11          A       -- model.

12          Q       In -- was TT-26 ranked first for  
13       optimization among the Tarawa Terrace wells?

14          A       I don't remember. Probably it --  
15                    (Whereupon, the court reporter  
16                    requests clarification.)

17       BY MS. O'LEARY:

18          Q       Was TT-26 ranked first for optimization  
19       among the Tarawa Terrace wells?

20          A       I don't remember that.

21          Q       Okay.

22          A       It must be in the record of this report.

23          Q       Can you go to H 23?

24                   All right.

25                   Actually, let's go on to H 29.



1 A Okay.

2 Q Looking at figure H 21.

3 Do you see figure H 21?

4 A Uh-huh.

5 Q Okay. Do you agree that figure H 21  
6 shows the simulated PCE concentrations at the Tarawa  
7 Terrace Water Treatment Plant when the results of  
8 minimum schedule one are run on PS Ops in the dashed  
9 line?

10 A Uh-huh.

11 Q And do you agree that the minimum  
12 schedule one was to run a late PCE arrival time at  
13 the Tarawa Terrace Water Treatment Plant?

14 A Uh-huh.

15 Q Okay. And do you agree that the solid  
16 pink line is the calibrated Tarawa Terrace model?

17 A Yeah.

18 Q Okay. And so the -- what has -- sort of  
19 being modeled as happening for the dashed pink line  
20 is that that pumping of Tarawa Terrace 26, TT-26 was  
21 minimized as much as it could be and still meet  
22 demand at the water plant?

23 A Exactly.

24 Q Is that right? Okay.

25 A Exactly.

1 Q And so for the dashed line run, other  
2 than pumping, were all of the other parameters the  
3 same as in the calibrated model?

4 A Yes.

5 Q Okay. So is the difference in magnitude  
6 between the dashed pink line and the solid pink line  
7 representing the difference in PCE concentration  
8 from the calibrated model and what it could  
9 theoretically be minimized at?

10 A Theoretically is the right word.

11 Q Yeah.

12 A Okay.

13 Q Right. So -- would you -- but that would  
14 be theoretically possible?

15 A Impossible. Exactly.

16 Q Okay. And am I, in looking at  
17 figure H 21, understanding correctly that it shows  
18 that if TT-26 were minimized as much as were  
19 theoretically possible --

20 A Yes.

21 Q -- to meet demand, then the ATSDR's model  
22 would otherwise not simulate any PCE contamination  
23 in the water supplied by the Tarawa Terrace Water  
24 Treatment Plant between about January of  
25 1960-something and January of 1972?

1 A That's correct.

2 Q Okay. And --

3 A But that's not theoretically possible.  
4 Because TT-26 is operating.

5 Q Sure. And I -- I want to go on next to  
6 H 38 --

7 A Okay.

8 Q -- and ask about another run that I think  
9 is -- is what you are talking about.

10 A Okay. That's fine.

11 Q So if we look at figure H 33 and --

12 A Figure on what page now?

13 Q H 38?

14 A H 38. Okay.

15 Q And then figure H 33?

16 A Okay.

17 Q And it says that it's the simulated PCE  
18 concentrations at the water treatment plant under  
19 the original schedule, solid line, minimum schedule  
20 one, and minimum schedule two, dashed lines.

21 A Uh-huh.

22 Q And so is minimum schedule two, is that  
23 where it's optimized to have a late PCE arrival time  
24 with the restriction that TT-26 had to pump at least  
25 25 percent --

1 A Yes.

2 Q -- of its pumping --

3 A Yes.

4 Q -- capacity?

5 A Exactly.

6 Q And why did you do the minimum schedule  
7 two run where TT-26 has to pump at least 25 percent  
8 of the time?

9 A Well, because that was more realistic in  
10 reference to what we were observing as how TT-26  
11 contributed to water treatment --

12 Q Okay.

13 A -- plant.

14 Q So more realistic in how it was --

15 A More realistic.

16 Q -- pumping?

17 A Yeah.

18 Q Okay. And in looking at figure H 33, is  
19 the -- the dashed line that has closer together  
20 dashes, is that the simulated PCE levels at the  
21 water treatment plant when that minimum schedule two  
22 is on? So the one where TT-26 is pumping at --  
23 at -- at least 25 percent --

24 A Right.

25 Q -- capacity?

1           A           If you extend that -- if you can see that  
2           dashed line extended to 1985, that will be the water  
3           treatment plant.

4           Q           Okay. And then is it true then that the  
5           difference between the tightly dashed line, the  
6           minimum schedule two line, and the solid dashed  
7           line, that's the difference in PCE concentration  
8           from the calibrated model and then the minimum  
9           schedule two where --

10          A           TT- --

11          Q           TT-- --

12          A           -- twenty-six.

13          Q           -- twenty-six is minimized but not below  
14          25 percent?

15          A           Right. Exactly.

16          Q           Okay. So this analysis of these minimum  
17          pumping schedules is in chapter H.

18                   And my question is: Why is this pumping  
19          uncertainty analysis in chapter H and not chapter I  
20          where the other uncertainty analyses are?

21          A           Because we didn't look at the variations  
22          of the other parameters in this uncertainty  
23          analysis. We only looked at the pumping schedule  
24          uncertain.

25          Q           In chapter I where the --

1 MS. O'LEARY: We can get 63.

2 We don't have it yet.

3 THE WITNESS: Oh, okay.

4 MS. O'LEARY: I'm getting it.

5 Sorry.

6 THE WITNESS: Uh-huh.

7 (Whereupon, Government's Exhibit Aral  
8 16, Chapter I Report, was marked for  
9 identification.)

10 BY MS. O'LEARY:

11 Q All right. This will be Exhibit --  
12 Government Exhibit 16, so the chapter I report.  
13 So in chapter I, I want to go to  
14 page I 55?

15 A Yes.

16 Q Okay. There's a figure I 29; is that  
17 what you're seeing?

18 A Yeah.

19 Q Okay. So I 29's label says it's the  
20 "concentrations of PCE in finished water at the  
21 water treatment plant derived from scenario one  
22 where pumping uncertainty was excluded and scenario  
23 two where pumping uncertainty was included in the  
24 probabilistic analysis using Monte Carlo as  
25 simulation at Tarawa Terrace."

1                   So the -- the Monte Carlo simulation, was  
2   that a probabilistic --

3           A       Yes.

4           Q       -- evaluation of uncertainty?

5           A       Yes.

6           Q       Okay. And to do that in the Monte Carlo  
7   simulations, did that involve model -- varying model  
8   input parameters?

9           A       Yeah.

10          Q       Okay. And so --

11          A       I have a diagram to show which  
12   parameters.

13          Q       In your report?

14          A       In the uncertainty analysis in my experts  
15   report.

16          Q       Yeah. And for what figure I 29 shows in  
17   terms of the pumping scenario -- from scenario one  
18   and two with pumping uncertainty included and not  
19   included, that pumping variation, that's different  
20   pumping variation than what was in chapter H;  
21   correct?

22          A       In what sense?

23          Q       Like in, like, scenario one and scenario  
24   two for pumping --

25          A       I think you are seeing the scenario

1 two --

2 Q Well --

3 A No. No. No. That's not correct.

4 This result now that you are seeing in

5 this chapter --

6 Q In chapter I?

7 A In chapter I.

8 -- includes uncertainty analysis of

9 pumping schedule variations --

10 Q Uh-huh.

11 A -- including uncertainty analysis of

12 pump -- parameter conditions together.

13 Q Right. But the pumping variation in

14 chapter I is not the same pumping variation --

15 A No.

16 Q -- of chapter H; right?

17 A No. No, no, it's not.

18 Q Okay.

19 A We are looking at maximum/minimum

20 conditions that we looked at earlier. This -- this

21 is the pumping uncertainty standard variations with

22 respect to statistical analysis --

23 Q Okay.

24 A -- that is reasonably what it is at the

25 site.



1           Q       And for the -- the variation in pumping  
2       that went into chapter I, that range, how was that  
3       range of parameters inputs selected?

4           A       Okay. That's a question. I have to go  
5       back and read that. I don't have an answer on top  
6       of my head.

7                    I think we looked at the distributions of  
8       possible pumping rate schedule changes. I mean, I  
9       have to read this whole report.

10                  I -- I don't have an answer to that --

11          Q       Okay.

12          A       -- right away.

13          Q       But it's different than chapter H?

14          A       It is different, yeah.

15          Q       And were the ranges of parameter inputs  
16       for the chapter I Monte Carlo simulations, were  
17       those the theoretical limits of parameters?

18          A       As far as we know from the site data, I  
19       think they were.

20          Q       In how -- in what way were -- would they  
21       be the theoretical limits?

22          A       Not theoretical. Whatever we have  
23       observed at the site in terms of hydraulic  
24       conductivities, in terms of other parameters, we  
25       came up with that range in uncertainty analysis as

1 the range to be used.

2 Q Okay. So does that mean then that for  
3 the Monte Carlo simulations, did the Monte Carlo  
4 simulations explore the theoretical range of  
5 possible solutions --

6 A Yes.

7 Q -- at Tarawa Terrace?

8 A We put probability distribution on a  
9 parameter within the range that it is defined.  
10 Monte Carlo analysis picks up data from that  
11 probability density function --

12 Q Sure.

13 A -- combines it with another parameter for  
14 its -- or from its probability density function,  
15 combines all that into the model --

16 Q Uh-huh.

17 A -- runs the model. You get one point on  
18 the slide.

19 Q But did the Monte Carlo simulation in- --  
20 involve simulating every possible combination of  
21 parameters --

22 A No.

23 Q -- within the --

24 A That would have --

25 Q -- ranges selected?

1           A       -- been a hundred years to run.

2           Q       Okay. But then how is it -- how is the  
3 Monte Carlo simulation then showing the theoretical  
4 range --

5           A       Okay.

6           Q       -- of possible solutions?

7           A       There's a method for that. That -- in  
8 hyperacute modeling.

9                   I think we ended up using only 810  
10 simulations from the PDFs database. And then I  
11 believe some of them dried out some of the wells. I  
12 believe it was 300 or so.

13                  So what is remaining for us to analyze is  
14 about 520 or so database to construct this  
15 uncertainty analysis.

16           Q       Yeah. But, I mean, that would mean then  
17 you are not looking at the theoretical range of --

18                   MR. DEAN: Object to the form.

19           A       No.

20 BY MS. O'LEARY:

21           Q       -- possible solutions?

22           A       That -- that doesn't mean that.

23                  The question here to ask is how many  
24 Monte Carlo simulations --

25           Q       Uh-huh.

1           A       -- is required to run a reasonable  
2       uncertainty analysis. In a case like this, the  
3       answer is 400.

4           Q       But that's not my question.

5           A       Yeah.

6           Q       Not what's reasonable.

7                   My question is whether the Monte Carlo  
8       simulation that was run for Tarawa Terrace explored  
9       the -- like, the universe of possible solutions?

10          A       The universe of the possible situations  
11       that was bound by the database that we chose for  
12       each parameter.

13          Q       Okay. And but that -- those bounds of  
14       parameters were not, like, the theoretical limits;  
15       those were selected from the site -- available site  
16       data?

17          A       Yeah.

18          Q       Okay.

19          A       It is based on site data.

20          Q       And then within the Monte Carlo  
21       simulation, it didn't -- it didn't test every  
22       possible combination of parameters?

23          A       It wouldn't be a Monte Carlo analysis  
24       then.

25          Q       Well, it would be another way of --

1 A It would be --

2 Q -- looking at uncertainty?

3 A -- running all the direct simulations for  
4 all the points on the PDF. That's an impossible  
5 act.

6 Q And so that's not what was done?

7 A How can we do it?

8 Q Okay. And so in figure I 29 --

9 A Uh-huh.

10 Q -- there's --

11 A Yeah.

12 Q -- areas between -- both for scenario one  
13 and scenario two, the --

14 A Yeah.

15 Q -- you know, pumping variation and no  
16 pumping variation.

17 There's an area between lines that says  
18 it's the range of concentrations representing  
19 95 percent of Monte Carlo simulations.

20 Do you agree that that range representing  
21 95 percent of Monte Carlo simulations for Tarawa  
22 Terrace is not equivalent to the 95 percent range of  
23 the universe of possible --

24 MR. DEAN: Object.

25

1 BY MS. O'LEARY:

2 Q -- mean historical contaminant  
3 concentrations --

4 MR. DEAN: Object --

5 MS. O'LEARY: -- at Tarawa Terrace.

6 MR. DEAN: Object to the form of the  
7 question.

8 A Okay. 95 percent within the bound of the  
9 PDF distribution that we have selected for that  
10 parameter is identified or selected by the method  
11 itself randomly. We are not assigning select this,  
12 select that, select -- no.

13 Randomly -- random -- random numbers are  
14 generated. Based on those random numbers, it goes  
15 and picks up some number some -- from some PDF  
16 distribution --

17 BY MS. O'LEARY:

18 Q Uh-huh.

19 A -- for some parameter matches up with  
20 another parameter PDF distribution number, puts them  
21 into the model, and then --

22 Q Yeah.

23 A -- then runs it.

24 Q Do you agree that the -- the total size  
25 of the universe of possible solutions to modeling

1 Tarawa Terrace is unknown?

2 A What do you mean by "universe"?

3 Q Like all of the ways that the model could  
4 have been set up, that all of the ways that the  
5 contaminants could have moved through time, that the  
6 size of that range is unknown?

7 MR. DEAN: Object to the form.

8 A So you are referring to that -- that  
9 statement to me means, Don't do a statistical  
10 analysis and just do all the possible points on a  
11 PDF function --

12 BY MS. O'LEARY:

13 Q Well --

14 A -- and run it through.

15 Q I think what I'm more trying to  
16 understand is how the Monte Carlo simulation and the  
17 confidence interval --

18 A Okay.

19 Q -- that's reported relates to the  
20 theoretical range --

21 A Okay.

22 Q -- of possible outcomes.

23 A I think the best way to answer is if you  
24 have a sample of 500 data point matchings from  
25 different PDF functions, the representation of that

1 outcome is 98.5 percent accurate with respect to the  
2 mean value that we have generated as a deterministic  
3 result.

4 Q But that's only within the parameter  
5 ranges that you evaluated; right?

6 A Well, it's the beginning of analysis.  
7 You cannot go back and question --

8 Q Yeah.

9 A -- what you started with.

10 Q Well, my question is about how that  
11 relates to not within the modeling world, but how  
12 that relates to what could have been possible in the  
13 real world?

14 MR. DEAN: Object to the form of the  
15 question.

16 A Okay. What you are referring to is you  
17 have not selected the proper bounds on the  
18 parameters that you inputted PDF functions. That's  
19 what you are telling me.

20 BY MS. O'LEARY:

21 Q Well, no.

22 A The universe means --

23 Q I'm asking how they relate?

24 A -- that to me.

25 Q No, I mean theoretically in the real



1 world, not in the parameter range that you select.

2 MR. DEAN: Object to the form of the  
3 question. There's no such thing as  
4 theoretically in the real world.

5 A Look, we decided to statist- -- to do a  
6 statistical analysis. The statistical analysis  
7 follows a standard procedure to be used in an  
8 application. And that standard -- standard --  
9 standard procedure is very simple, it's not complex.  
10 BY MS. O'LEARY:

11 Q Uh-huh.

12 A It's very simple. It says, Give us the  
13 bounds of each parameter you think represents the  
14 conditions at the site.

15 Q Uh-huh.

16 A That's number one.

17 Then fit a probability density function  
18 within that range to represent the distribution of  
19 that parameter. That represents the conditions at  
20 the site.

21 The third stage. You go and throw dice  
22 or -- or flip a coin, it becomes a random number.  
23 It goes back into the PDF function, picks one number  
24 out of that and another number out of the other PDF,  
25 combines that. That's the statistical procedure.

1           You cannot -- once you decide to do this,  
2           you cannot divert and ask questions. What you are  
3           doing, is it representing the universe?

4           No, we are modeling the universe.

5           MS. O'LEARY: And I can go on to 42.  
6           This will be a Hadnot Point --

7           A       Okay.

8           MS. O'LEARY: -- summary.

9           Actually, do you have that already?

10          MS. BAUGHMAN: You did mark a  
11          summary --

12          MS. O'LEARY: Yeah, I think we  
13          marked -- let me find that one.

14          MS. HORAN: I have it as Exhibit 4.

15          MS. O'LEARY: Exhibit 4 should be  
16          hopefully in this stack here.

17          THE WITNESS: Okay.

18          Okay.

19       BY MS. O'LEARY:

20           Q       There you go. It's rather thick.

21           A       Chapter A.

22           Q       Yeah, chapter A and then just to page iii  
23           in the forward?

24           A       Four --

25           Q       Iii.

1 A Iii. Okay.

2 Q Oh, in the forward, yeah.

3 A Wait a minute.

4 Are there two reports in here or --

5 Q No, it should be right near the  
6 beginning, Professor Aral.

7 I think it might have been before that.

8 A Iii. Okay. I see it. Forward.

9 Q Okay. Yeah. So it says in the first  
10 paragraph, "The Agency for Toxic Substances and  
11 Disease Registry, an agency of the U.S. Department  
12 of Health and Human Services, is conducting  
13 epidemiological studies to evaluate" --

14 A Yeah, we read this earlier.

15 Q Well, we read it in Tarawa Terrace.

16 A Oh, did we?

17 Q Yeah.

18 A This is what?

19 Q This is Hadnot Point.

20 A Oh, really? Okay.

21 Q Yeah.

22 A Okay. Good.

23 Q So -- "was conducting epidemiological  
24 studies to evaluate the potential for health effects  
25 from exposure to volatile organic compounds such as

1 tetrachloroethylene, trichloroethylene, and benzene  
2 in drinking finished water at U.S. Marine Corp Base  
3 Camp Lejeune, North Carolina. Historical exposure  
4 data needed for the epidemiological studies are  
5 limited. To obtain estimates of historical  
6 exposures, ATSDR is using" --

7 (Whereupon, the court reporter  
8 requests clarification.)

9 BY MS. O'LEARY:

10 Q -- "ATSDR is using water modeling  
11 techniques" --

12 (Whereupon, the court reporter  
13 requests clarification.)

14 BY MS. O'LEARY:

15 -- "data needed for the epidemiological  
16 studies are limited. To obtain estimates of  
17 historical exposures, ATSDR is using water modeling  
18 techniques and the process of historical  
19 reconstruction to quantify concentrations of  
20 particular contaminants in finished water and to  
21 compute the level and duration of human exposure to  
22 contaminated drinking water."

23 Were you aware when you were working on  
24 the Hadnot Point water -- water modeling of this  
25 purpose stated in the forward?

1           A           I wasn't aware of the details of this  
2           purpose, but I was aware of the fact that this study  
3           was going to be followed by an epi study.

4           Q           An epidemiology --

5           A           Yeah.

6           Q           -- study?

7                       Okay. And still in the Hadnot Point  
8           chapter A, so Exhibit 4, if you could go to  
9           page A 62?

10          A           Okay.

11                       Yes.

12          Q           And the top left, the first paragraph of  
13          A 62 where it begins, "Using reconstructed"?

14                       Do you see that?

15          A           A 6 --

16          Q           I think you're --

17          A           Sixty-two.

18          Q           -- on the right page.

19                       A 62, yeah. On the top left?

20          A           Yeah.

21          Q           Okay. So it says, "Using reconstructed  
22          simulated water supply well concentrations  
23          previously discussed, monthly mean concentrations of  
24          PCE, TCE, 1,2-TDCE, VC, and benzene were estimated  
25          for finished water at the Hadnot Point water

1 treatment plant. These estimates were computed  
2 using a materials mass balance model simple mixing  
3 to compute the flow-weighted mean concentrations of  
4 VOCs as described earlier in this section on  
5 computation of contaminated finished water  
6 concentrations."

7 So does -- is it the case that the ATSDR  
8 only modeled at Hadnot Point Holcomb Boulevard PCE,  
9 TCE, 1,2-TDCE, VC, and benzene?

10 A What's the last one?

11 Q Benzene?

12 A Oh, benzene? Yes.

13 Q Okay. And you aren't offering opinions  
14 about historical concentrations of any other  
15 compounds at the Hadnot Point or Holcomb Boulevard  
16 areas.

17 A Not --

18 Q Is that correct?

19 MR. DEAN: Object to the form.

20 BY MS. O'LEARY:

21 Q Is that correct?

22 A Not other than these listed.

23 Q So --

24 A Yeah.

25 Q -- trichloroethylene,

1     tetrachloroethylene --

2             A       Yeah.

3             Q       -- dichloroethylene, vinyl chloride, and  
4     benzene?

5             A       Yes.

6             Q       Okay. And in that same page where it  
7     says, "These estimates were" -- so still this is  
8     A 62?

9             A       Okay.

10            Q       It said, "These estimates were computed  
11     using a materials mass balance model simple mixing."

12                    Do you agree that -- that Hadnot Point  
13     model also did not include a calculation for loss of  
14     contaminants in the water treatment plant?

15            A       As far as our analysis go, no.

16            Q       What do you mean "our analysis"?

17            A       I mean the water -- water modeling  
18     analysis --

19            Q       Oh, okay.

20            A       -- that we have done. Yeah.

21            Q       So water modeling did not involve a  
22     calculation for contaminant losses in the water --

23            A       That's --

24            Q       -- treatment plant?

25            A       -- correct.

1           Q       And we are going to set aside this one  
2       for a bit.

3                   MS. O'LEARY:   And can we get -- this  
4       will be 39.

5                   There we go.

6                   THE WITNESS:   Are we done with this?

7                   MS. O'LEARY:   We are done with that  
8       one, yes.

9                   THE WITNESS:   Okay.

10                   (Whereupon, Government's Exhibit Aral  
11       17, Chapter A Supplement Two for  
12       Hadnot Point, was marked for  
13       identification.)

14       BY MS. O'LEARY:

15           Q       Thank you.

16                   So Professor Aral, this is Government  
17       Exhibit 17?

18           A       Okay.

19           Q       Professor Aral, this looks like a copy of  
20       the chapter A supplement two for Hadnot Point.

21                   Is that what it looks like to you?

22           A       Yeah.

23           Q       And am I correct in understanding that  
24       you are an author on this --

25           A       Yes.



1 Q -- chapter?

2 All right. I have a few quick questions  
3 for you --

4 A Uh-huh.

5 Q -- on page S2.74?

6 A Yes.

7 Q Okay. And -- I'm on the wrong page.  
8 There we go.

9 I want to look at figure S2.99; do you  
10 see that figure?

11 A 299, yes.

12 Q Okay. It says, "Estimated monthly  
13 operating days for well HP-634."

14 Do you agree that figure S2.99 shows the  
15 number of days per month that HP-634 was modeled as  
16 pumping in the ATSDR's calibrated model for Hadnot  
17 Point?

18 A As a outcome of the modeling sequence  
19 that we have used, that seems to be the case. But  
20 it's not daily. I think it's monthly.

21 Q Sure. So --

22 A Okay.

23 Q -- so the -- so it -- well, the scale on  
24 the left says days?

25 A Is it?

1 Oh, day.

2 No, number of days --

3 Q So then the line would represent total  
4 number of days per month.

5 So the time scale would be monthly?

6 A Yes.

7 Q And then --

8 A Yes.

9 Q -- it's showing its days?

10 A Yes.

11 Q Okay.

12 A Monthly versus days, yeah.

13 Q And do you agree that figure S 2.99 shows  
14 that in the calibrated HP model, HP-634 was not  
15 modeled as pumping after January of 1985?

16 A Yes.

17 Q Okay. All right. That's my only  
18 question on that. But we'll stay in -- well, maybe.  
19 We are going to --

20 MR. DEAN: Can we take a break?

21 MS. O'LEARY: Sure.

22 MR. DEAN: Are you okay with that?

23 MS. O'LEARY: Yeah, that's fine.

24 THE VIDEOGRAPHER: The time right  
25 now is 2:59 p.m. We are off the record.

1 (Whereupon, there was a recess taken  
2 from 2:59 p.m. to 3:12 p.m.)

3 THE VIDEOGRAPHER: Time right now is  
4 3:12 p.m. We are back on the record.

5 BY MS. O'LEARY:

6 Q Professor Aral, I have a few more  
7 questions for you in the Hadnot Point supplement  
8 two.

9 So this is Exhibit 17 -- Government 17?

10 A Okay.

11 Q And could you go to page S 2.2.  
12 All right?

13 A Uh-huh.

14 Q I think that is one --

15 A Two.two -- oh, 2.4, I'm sorry.  
16 Yeah.

17 Q Okay. So in the data availability data  
18 sources section, so the column on the right?

19 A Uh-huh.

20 Q It says, "Four types of data sources  
21 pertinent to water supply well operational records  
22 and water treatment plant raw water records are used  
23 in the supplement. These are: one, daily  
24 operational records for January 1998 to  
25 June 2008" -- and skipping the parenthesis --

1 "number two, Camp Lejeune historic drinking water  
2 consolidated document repository records; three,  
3 Camp Lejeune water documents; and four, U.S.  
4 geological survey well inventory documents."

5 A Uh-huh.

6 Q "Using these data sources, operational  
7 chronologies for 96 wells supplying groundwater, raw  
8 water to the Hadnot Point Water Treatment Plant and  
9 Holcomb Boulevard Water Treatment Plant were  
10 developed."

11 And so Professor Aral, why did  
12 operational chronologies for these 96 wells have to  
13 be developed?

14 A I was not involved in data collection, so  
15 I have no idea what this is telling us about.

16 Q Okay. Then we can go on to page S2.12.

17 And so just to start out, were  
18 operational histories reconstructed for the Hadnot  
19 Point water supply wells?

20 A Can you repeat that question, louder  
21 please?

22 Q Sure. Were operational histories  
23 reconstructed for the Hadnot Point water supply  
24 wells?

25 A I don't -- I don't remember that.

1           Q       Okay. So on S2.12 in that first  
2 paragraph on the top left?

3           A       Uh-huh.

4           Q       It says, "Similar to the training" -- or  
5 after that, actually, a couple sentences.

6                    It says, "Because some wells did not  
7 physically exist during the training period,  
8 surrogate wells were selected to represent these  
9 untrained wells."

10                   So do you know what the training period  
11 is a reference to?

12          A       I have to read this paragraph here.

13          Q       Sure.

14          A       "Similar to..."

15                   Looks like they are trying to come up  
16 with a operational well history on the site as to  
17 when they were operated, when they were not  
18 operating. That's what this refers to.

19          Q       Okay.

20          A       Yeah.

21          Q       Were you involved in a -- like, a  
22 training process for the Hadnot Point wells?

23          A       No.

24          Q       Okay. And then we can set aside this  
25 supplement --

1 A Okay.

2 Q -- two from Hadnot Point and go back to  
3 Exhibit 4, the Hadnot Point chapter A, to page 80 --  
4 80 -- excuse me -- A 84?

5 A Okay.

6 Q And so Professor Aral, A 84, this section  
7 is titled "Trichloroethylene Source Release Date  
8 Sensitivity Analysis."

9 Were you involved in the  
10 trichloroethylene source release date sensitivity  
11 analysis at Hadnot Point?

12 A No, I don't think so.

13 Q You were not?

14 A I don't remember that.

15 I mean, which area is this on Hadnot  
16 Point --

17 Q Hadnot Point --

18 A -- industrial area or the landfill area  
19 or which one?

20 Q So the source release date sensitivity  
21 analysis --

22 A Yeah.

23 Q -- I think it involved both?

24 A Both?

25 Q Yeah.

1           A       No, I'm -- I don't remember this.

2           Q       Okay. Can you take a look at the next  
3 page, A 85?

4           A       Uh-huh.

5           Q       There's a figure, A 37 -- actually,  
6 sorry. Just a minute.

7                   I'll come back to that. I think we can  
8 set aside actually the chapter A for Hadnot Point.

9                   MS. O'LEARY: And can we get -- it  
10 will be 40. It will be Hadnot Point  
11 supplement six.

12                  MS. HORAN: I believe that's  
13 Exhibit 11.

14                  MS. O'LEARY: That's Exhibit 11.  
15 Okay.

16 BY MS. O'LEARY:

17           Q       Professor Aral, could you grab  
18 Exhibit 11?

19           A       Exhibit 11?

20                   MS. O'LEARY: Oh, yes. There it is.

21                   THE WITNESS: Yeah. It's there.

22 BY MS. O'LEARY:

23           Q       Okay. So on Exhibit 11, page S6.17.

24           A       Again, this is a supplement that I wasn't  
25 an author on.

1 Q No?

2 Okay.

3 A Okay.

4 Q So actually, going one page -- rather  
5 than S6.17, S6.16. So just the page before.

6 Do you see a table S6.5?

7 A Okay.

8 Q And it says it's calibrated contaminant  
9 fate transport model parameter values used to  
10 describe contaminant sources in the Hadnot Point  
11 industrial area and Hadnot Point landfill area,  
12 Hadnot Point Holcomb Boulevard study area.

13 Were you involved in selecting the  
14 calibrated contaminant, like, mass loading rates?

15 A Which is presented in this report?

16 Q No. In general, at Hadnot Point?

17 A But we are looking at this report.

18 Is that in this report? That's what I'm  
19 asking. Is that database is in this report?

20 If it is not, I would like to go back to  
21 the database that was used later on in another study  
22 and see if I was the author on that.

23 Q Oh, so -- so you're saying you're not  
24 sure if you were involved in --

25 A I'm involved --



1 Q -- that?

2 A -- in it. But I'm looking at a table --

3 Q Uh-huh.

4 A -- which I have not prepared.

5 And I'm not ready to answer questions on  
6 it, because I was not involved in writing this  
7 report.

8 Q Okay. So, I -- I mean, I think this is  
9 the report where these contaminant mass loading  
10 rates are reported in the Hadnot Point reports.

11 A But some other group did it. There's a  
12 different group in every task, and they write  
13 whatever they write.

14 If I have used it in another study  
15 related to this industrial area or landfill area,  
16 let's go to that report and discuss it there.

17 Q Well, I guess that's what I'm asking you.

18 Did you use -- in the areas you worked  
19 on, did you use the --

20 A I would --

21 Q -- the fate --

22 A -- like to --

23 Q -- and transport --

24 A -- go back --

25 Q -- buckles?

1           A       -- to the report that I wrote, listed  
2 these numbers. Then, I would say, Yes, I have used  
3 it.

4                   It may be totally "irrelevant" --  
5 irrelevant to my application. I don't know.

6 BY MS. O'LEARY:

7           Q       Okay.

8                   MS. O'LEARY: Can we get -- this  
9 will be -- we can set aside 11,  
10 Exhibit 11.

11                   And can we get 25?

12                   THE WITNESS: Okay.

13                   MS. O'LEARY: You don't have it yet,  
14 Professor Aral.

15                   THE WITNESS: Okay.

16                   MS. O'LEARY: It will end up being,  
17 I think, Government Exhibit 18.

18                   THE WITNESS: Okay.

19                   (Whereupon, Government's Exhibit Aral  
20 18, E-mail String Between Robert Faye  
21 and Mustafa Mehmet Aral, was marked  
22 for identification.)

23                   MS. O'LEARY: Yup.

24                   And I have some questions about  
25 calibration of Hadnot Point.

1 THE WITNESS: Okay.

2 MS. O'LEARY: There you go.

3 THE WITNESS: Okay.

4 BY MS. O'LEARY:

5 Q Professor Aral, Government Exhibit 18  
6 appears to be an e-mail from you to Robert Faye from  
7 September 21st of 2011.

8 Do you recognize this e-mail?

9 A Yeah. It's from me.

10 Q Do you remember it?

11 MS. BAUGHMAN: You should take your  
12 time to read it first.

13 THE WITNESS: Yeah. I'm reading it.

14 BY MS. O'LEARY:

15 Q Professor Aral, are you -- what page are  
16 you on reading?

17 A I'm reading the whole e-mail sequence.

18 Q Okay. I thought you had mentioned that  
19 you did re- -- you did recognize this e-mail?

20 MR. DEAN: He did, but we --

21 A Yeah. But this was ten -- how many years  
22 ago?

23 BY MS. O'LEARY:

24 Q Okay. Would you like --

25 A I have to read the whole thing to

1 answer --

2 Q Yeah. Would --

3 A -- questions.

4 Q -- you like to go off record so you can  
5 read it?

6 And we can --

7 MR. DEAN: No.

8 BY MS. O'LEARY:

9 Q -- come back on record when you're ready?

10 MR. DEAN: No. Keep the record  
11 rolling. But --

12 MS. O'LEARY: No. We --

13 MR. DEAN: -- if it's --

14 MS. O'LEARY: -- can -- we can take  
15 a break --

16 MR. DEAN: No. It's --

17 MS. O'LEARY: -- if you need to read  
18 all of the pages.

19 So let's go off the --

20 MR. DEAN: No. No.

21 MS. O'LEARY: -- record, please.

22 MR. DEAN: Absolutely do not stop  
23 the videotape rolling. You can stop  
24 transcribing if you'd like.

25 But he's going to continue to read

1           it. You're the one that asked him a- --  
2           about the e-mail. He has a right to read  
3           it.

4           There's nothing that suggests that  
5           we have to turn off the record every time  
6           you present him with an exhibit, which he  
7           has a right --

8           MS. O'LEARY: Yes. But --

9           MR. DEAN: -- to read --

10          MS. O'LEARY: -- he's -- he's --

11          MR. DEAN: -- and stop --

12          MS. O'LEARY: -- already said --

13          MR. DEAN: -- the transcript.

14          MS. O'LEARY: -- he recognized the  
15          e-mail.

16          So Professor Aral, I'm fine to go  
17          off record for you to read every word --

18          MR. DEAN: No.

19          MS. O'LEARY: -- and not on the  
20          record.

21          So are you ready to proceed --

22          MR. DEAN: He can --

23          MS. O'LEARY: -- or not?

24          MR. DEAN: -- keep reading, but  
25          we'll keep the record running.

1           A       Can you tell me which part of this --

2       BY MS. O'LEARY:

3           Q       Sure.

4           A       -- your question --

5           Q       Yeah?

6           A       -- is all about?

7           Q       Sure.

8           A       I can have a focus on that.

9           Q       Yeah. So I have questions for you about  
10       page one and page two.

11          A       Okay. So what is your question?

12          Q       So on page two, there's an e-mail from  
13       you to Robert Faye that's dated September 20th --

14          A       Uh-huh.

15          Q       -- 2011.

16                 The subject says, Re: TCE landfill data.  
17       And in the paragraph there, it's addressed to Bob.

18                 Is that to Robert Faye?

19          A       That's to Bob -- yeah. Bob Faye.

20          Q       Okay. So, kind of, in the middle,  
21       there's a sentence that begins, Here, I'm not  
22       referring to CT application we did two years ago.

23                 Do you see that?

24          A       Yeah.

25          Q       And it says, We did -- we did what we had

1 to do. The outcome of our assumption seems to yield  
2 pretty good answers, given what we did not know or  
3 how little we know at the time and how little we  
4 included in our overall analysis to come to that  
5 conclusion. I am interested in hearing your  
6 thoughts on the calibration targets for GW fate and  
7 transport models.

8 So just background, "CT" is that control  
9 theory application?

10 A Yeah.

11 Q And when you say "GW," is that  
12 groundwater?

13 A GW, groundwater.

14 MS. BAUGHMAN: Is -- isn't -- isn't  
15 "CT" calibration target?

16 THE WITNESS: Well, it can be that,  
17 too, referring to calibration targets.  
18 Yeah.

19 MS. BAUGHMAN: Because the --

20 THE WITNESS: That's right.

21 MS. BAUGHMAN: -- prior e-mail --

22 THE WITNESS: That's correct.

23 MS. BAUGHMAN: -- is all about that.

24 THE WITNESS: It's calibration --  
25

1 BY MS. O'LEARY:

2 Q All right. This is about tal- --  
3 calibration targets?

4 A Correct.

5 Q You are not referring to calibration  
6 target application you did two years ago?

7 A Calibration targets -- probably, I'm  
8 referring to Tarawa Terrace.

9 MR. DEAN: Object to the form of the  
10 question.

11 MS. BAUGHMAN: I -- I really think  
12 you need to read the prior e-mail on --  
13 on -- from Bob Faye to you right before  
14 this e-mail, or you might understand the  
15 context.

16 BY MS. O'LEARY:

17 Q Well, Professor, hadn't you already read  
18 page three?

19 A The first e-mail is from me to Bob.

20 Q Uh-huh.

21 A Apparently, we had a meeting or a  
22 conversation on -- or during which I have asked him  
23 some calibration targets that he has or he may not  
24 have in his mind.

25 So that's the start of the discussion.



1 He answers --

2 MS. BAUGHMAN: Wait. Wait. Wait.

3 What -- you've got to -- she needs  
4 to ask you a question. Okay?

5 You're just -- you're just  
6 explaining the e-mail.

7 Wait for a question.

8 BY MS. O'LEARY:

9 Q Pro- --

10 MS. BAUGHMAN: But make sure you've  
11 read the whole --

12 BY MS. O'LEARY:

13 Q So Pro- --

14 MS. BAUGHMAN: -- chain first.

15 BY MS. O'LEARY:

16 Q Professor Aral, let me just ask my  
17 specific questions, and this --

18 A Please.

19 Q -- might go better.

20 So do you agree that this e-mail --

21 A And loud --

22 Q -- thread -- the --

23 A -- please.

24 Q -- one -- yeah.

25 Do you agree that that e-mail on

1 September 20th, 2011, from you to Robert Faye -- so  
2 the one on page two --

3 A (The witness nods head.)

4 Q -- that this e-mail is about calibration  
5 targets for TCE at HP651?

6 A In page two?

7 Q Yes.

8 A Uh-huh.

9 Q You agree?

10 MR. DEAN: Object to the form of the  
11 question.

12 A Can you repeat that --

13 BY MS. O'LEARY:

14 Q Yeah.

15 A -- what are --

16 Q You agree that e-mail is about -- about  
17 calibration targets for TCE at Hadnot -- HP651, the  
18 well?

19 A Okay. Which page is this that you're --

20 Q Two.

21 A -- reading?

22 Q Right here, in the --

23 A Second page?

24 Q Yes.

25 A From me to Bob?

1 Q That's right.

2 A Okay.

3 Okay. What is your question again?

4 Q All right. When you said, We did what we  
5 had to do, what did you mean?

6 What is it that you had --

7 A We change --

8 Q -- to do?

9 A -- we chose a proper calibration target,  
10 and we went about applying it.

11 Q Okay. And you said, The outcome of our  
12 assumptions seems to yield pretty good answers given  
13 that we did not know or how little we knew at the  
14 time and how little we included in our overall  
15 analysis to come to that conclusion.

16 What is -- what do you mean by the  
17 "outcome of our assumptions"?

18 A I think we made some assumptions to  
19 choose a calibration target, and it worked out in  
20 the final analysis in the sense that our modeling  
21 application yielded good results. And I think I'm  
22 referring to Tarawa Terrace there.

23 Q Uh-huh.

24 A So I'm suggesting, maybe, why don't we  
25 use the same approach, come up with a proper

1 calibration target, and go at it?

2 Q And the way you did it at Tarawa --

3 A Right.

4 Q -- Terrace, do it at Hadnot Point?

5 A Right.

6 Q Okay. And then, on page one of this  
7 e-mail -- so the page one of Exhibit 18 --

8 A Uh-huh.

9 Q -- in the e-mail from Robert Faye to you  
10 and others that's dated September 20th, 2011, do you  
11 see that one?

12 A Yup.

13 Q It says, Hi, folks. First, it seems to  
14 me, the overall model calibration strategy has  
15 always been and should be to apply defensible  
16 methods to simulate field observations.

17 Second, our models only grossly  
18 approximate real-world physics, chemistry, and  
19 biology.

20 Third, the feed -- field data represent a  
21 snapshot in time during one day, whereas our model  
22 simulate average monthly conditions. It seems to me  
23 that an effective and a ap- -- appropriate approach  
24 to model calibration must integrate these realities  
25 into the -- into a practical strategy.

1                   And then, there's one more sentence.

2                   But do you agree with what Robert Faye  
3                   said, that the ATSDR's HP models only grossly  
4                   approximate real-world physics, chemistry, and  
5                   biology?

6                   MR. DEAN: Object to the form of the  
7                   question.

8                   A        No.

9                   I think what he's trying to do, if I -- I  
10                  don't recall -- recall this e-mail sequence. But he  
11                  may be suggesting different calibration targets than  
12                  what we have used at Tarawa Terrace.

13                  And probably, I'm insisting that what we  
14                  did at Tara- -- Tarawa Terrace worked for us. So  
15                  let's continue with the same approach, same targets,  
16                  and it will work for this case, as well.

17                  BY MS. O'LEARY:

18                  Q        Why is it that the models are not grossly  
19                  approximating real-world physics, chemistry, and  
20                  biology?

21                  A        Well --

22                  MR. DEAN: Object to the form of the  
23                  question.

24                  That's not his e-mail.

25                  THE WITNESS: Yeah.

1 MR. DEAN: That's Bob Faye's e-mail.

2 THE WITNESS: Yeah.

3 MS. O'LEARY: That I -- I understand  
4 that. And --

5 MR. DEAN: Okay. Well --

6 MS. O'LEARY: -- I asked --

7 MR. DEAN: -- you're implying --

8 MS. O'LEARY: -- him if --

9 MR. DEAN: -- that he --

10 MS. O'LEARY: -- he agreed.

11 MR. DEAN: -- said that. You're  
12 implying to him --

13 MS. BAUGHMAN: He did -- he did not  
14 agree.

15 MS. O'LEARY: All right. And I'm  
16 asking him, Why?

17 BY MS. O'LEARY:

18 Q Why is it that the models don't  
19 grossly --

20 A Well, because --

21 Q -- approximate real-world --

22 A -- the -- the --

23 Q -- physics -- I'm --

24 A -- models we --

25 Q -- sorry. Sorry --

1           A       -- are using --

2           Q       -- Professor Aral.

3           A       Okay.

4           Q       -- don't grossly approximate real-world  
5 physics, chemistry, and biology?

6                   MR. DEAN: Object to the form.

7           A       I don't agree with that.

8 BY MS. O'LEARY:

9           Q       Right.

10                   Why? Why don't you agree?

11          A       Because our models are good models.

12          Q       But, I mean, can't a model be good and  
13 still be only a gross approximation?

14          A       No, it wouldn't be --

15          Q       Why not?

16          A       -- if it is done -- if it is done well,  
17 calibrated well, the model represents the  
18 assumptions you have initially introduced into it  
19 and predicts what those initial assumptions --  
20 assumptions you have mathematically correctly.

21          Q       Mathematically correctly, though.

22                   But, I mean, we're talking about how it  
23 compares to the real world. Right?

24                   The real world isn't in, for example --

25          A       Well, then --

1 Q -- seven layers.

2 A -- it --

3 Q And that's what the model had. Correct?

4 A Yes. That they plot --

5 Q And then, the --

6 A Yeah. Go ahead.

7 Q The real world's not in 50 by 50 squares.

8 But that's what the model had. Right?

9 A Right.

10 Q And the real world has variable  
11 biodegradation rates based on changing parameters  
12 throughout the distance between a contaminant source  
13 and the wells.

14 And the model didn't have that. Right?

15 A The model we have worked with is an  
16 approximation of the environment we are working  
17 in -- with.

18 And we are satisfied with the  
19 representation of that environment within that  
20 model, and we are trying to go through the  
21 discussion of how far should we go further in time  
22 spent in calibrating this model --

23 Q Uh-huh.

24 A -- to best fit what we have observed at  
25 the field?



1           So this is not a question of whether the  
2       model represents the field conditions correctly or  
3       grossly. That's not the question.

4           The question is what we have assumed in  
5       building this model represents the field -- or -- or  
6       the -- the -- the environment approximately, but  
7       correctly in terms of our understanding at the  
8       beginning. Okay?

9           So when we start there, we cannot argue  
10      whether the results are gross or exact.

11           Q       Because you just don't know?

12           A       No.

13           We know a bound of analysis based on  
14      uncertainty, that it should reflect the -- the field  
15      conditions within a certain degree of accuracy.

16           Q       But only within the -- the range of  
17      parameters you chose to look at for the field --

18                   MR. DEAN: Object to the form.

19      BY MS. O'LEARY:

20           Q       -- parameters; correct?

21           A       We are modeling. We cannot use all the  
22      range of field parameters that is available to us.

23           Q       Okay. You can set aside Exhibit 18. And  
24      if you could find Exhibit 4, the Hadnot Point  
25      Chapter A?

1 MR. DEAN: Supplement two?

2 MS. O'LEARY: No. Chapter A.  
3 Exhibit four.

4 MS. BAUGHMAN: That would be  
5 Exhibit four. Yeah.

6 MR. DEAN: Oh.

7 THE WITNESS: Uh-huh.

8 MR. DEAN: Yeah.

9 BY MS. O'LEARY:

10 Q And could you go to page A46?

11 And so there's a figure there, Figure  
12 A18. And its label says, Reconstructed Simulated  
13 and Measured Concentrations of Trichloroethylene and  
14 Selected Water Supply Wells Within the Hadnot Point  
15 Industrial Area.

16 A Uh-huh.

17 Q So --

18 A That's figure eight, 18 -- A18.

19 Q A18. Yes.

20 A Yeah.

21 Q Do you agree that this Figure A18 shows  
22 the calibrated model values plotted with some  
23 measured values at HP well 601, 602, 608, and 634?

24 A Yeah. That's what the titles say.

25 Q Do you agree that the Figure A18 shows

1 some of the measured values at those wells, but not  
2 the non-detections?

3 A Uh-huh.

4 Q Okay. And so any non-detections are not  
5 on these -- on these graphs?

6 A I have no idea.

7 You are just referring to four figures,  
8 four wells, and then, asking a universal question  
9 as --

10 Q No. I --

11 A -- to all --

12 Q -- mean, for --

13 A -- the wells.

14 Q -- no. I mean, for these four wells, the  
15 non-detections are not --

16 A I don't --

17 Q -- shown?

18 A -- know.

19 Q Okay.

20 A I don't remember that.

21 MS. O'LEARY: Can we get number 43?

22 And I'm -- I'm going to have you --  
23 I'm going to need you to compare. So if  
24 you could keep Exhibit --

25 THE WITNESS: Okay.

1 MS. O'LEARY: -- 4 nearby.

2 This will be Government Exhibit 19.

3 (Whereupon, Government's Exhibit Aral  
4 19, Chapter C at Hadnot Point, was  
5 marked for identification.)

6 THE WITNESS: Uh-huh.

7 BY MS. O'LEARY:

8 Q And can you go to page C95?

9 A C95?

10 Q Yup.

11 Okay. Professor, are you on page C95?

12 And you should be looking at a Table C7?

13 A Yes.

14 Q Okay. So that table says it's a summary  
15 of analyses of PCE, TCE, DCE of various kinds and  
16 vinyl chloride in samples collected in Hadnot Point  
17 water treatment plant water supply wells.

18 So I'd like you to look at HP634, and  
19 look at the TCE column.

20 A Uh-huh.

21 Q And there are, looks like, four  
22 non-detections.

23 Do you see those?

24 A Yes.

25 Q Okay. So there are four non-detections

1 of TCE at HP634, for example.

2 But if we go back to Exhibit 4, which is  
3 the Chapter A, at that figure A18 on page A46, for  
4 wells 634, there are no non-detections on that  
5 chart. Is that correct?

6 A 634?

7 Non-detects are not shown in here as a  
8 data point.

9 Q Yeah. Okay. You can set aside Exhibit  
10 19, which was the Chapter C at Hadnot Point.

11 A Chapter what?

12 Q You can set aside --

13 A Okay.

14 Q -- Exhibit 19.

15 A Okay.

16 Q So Chapter -- Exhibit 4 please keep. And  
17 you can set aside --

18 A Okay.

19 Q -- Exhibit 19.

20 And can you go in Exhibit 4, Chapter A,  
21 to page A51?

22 A Yes.

23 Q All right. So there's a figure A20 that  
24 says --

25 A Yeah.

1           Q       -- it's reconstructed, simulated, and  
2 measured concentrations of benzene at selected water  
3 supply wells at Hadnot Point industrial area, Hadnot  
4 Point Holcomb Boulevard study.

5                   And it's showing three wells, HP 602, HP  
6 603, and HP 608.

7                   And were you involved at all -- or are  
8 you aware of the data on benzene detections at the  
9 Hadnot Point water treatment plant?

10           A       Well, it says "TechFlowMP." So I must be  
11 involved.

12           Q       Okay. So -- and are you, then, familiar  
13 with the benzene detections at the wells in Hadnot  
14 Point?

15           A       These are the data points that we had,  
16 apparently, on benzene on these wells.

17           Q       Okay. Do you agree that these figures  
18 show calibrated model benzene concentrations at  
19 these three wells -- HP 602, 603, and 608, as well  
20 as some measured values?

21           A       Yup.

22           Q       Okay. If I look at well HP 603, I don't  
23 see any measured values.

24                   Do you know why that is?

25           A       I don't know.

1                   There must be no data on that.

2           Q       Why do you think there must be no data on  
3   that?

4           A       Well, we didn't put data points on that  
5   figure.

6           Q       Okay. Can you pull back up Exhibit 19,  
7   the Chapter C for Hadnot Point?

8           A       Yes.

9           Q       And go to page C98.

10          A       Okay.

11          Q       So if you look at -- now, this -- there's  
12   a Table C8.

13          A       Uh-huh.

14          Q       And it says, Summary of Analyses for  
15   Benzene, Toluene, Ethylbenzene, and Total Xylene in  
16   Water Samples Collected in Hadnot Point Water Supply  
17   Wells.

18                   And do you see the entries for HP 603 in  
19   the column for benzene?

20          A       Uh-huh.

21          Q       All right. Do you see that there are  
22   seven entries for benzene, and they're all  
23   non-detections?

24          A       Yes.

25          Q       Okay. So does that mean that in --

1 A These plots didn't include non-detects.

2 Q You didn't include the non-detects --

3 A Correct.

4 Q -- in well HP 603?

5 A Yeah.

6 Q Okay. So I --

7 MR. DEAN: Objection to form.

8 They don't show up on log scales  
9 anyway.

10 A Uh-huh.

11 BY MS. O'LEARY:

12 Q So if you look at -- back at page A51,  
13 that --

14 A Uh-huh.

15 Q -- figure A20?

16 A Uh-huh.

17 Q For H -- well HP603, what does the red  
18 line represent?

19 A 603?

20 Q 603. I'm sorry. I might have said  
21 something wrong.

22 603?

23 A Yeah. Okay.

24 Q What does the red line represent?

25 A The simulated benzene concentrations at



1 this well location.

2 Q Okay. And does the -- am I correct in  
3 understanding this shows the simulated benzene  
4 concentrations at -- at well HP603 at some point  
5 exceeded a hundred micrograms per liter?

6 A It shows that.

7 Q But then when we looked at the table in  
8 chapter C --

9 A Uh-huh.

10 Q -- there were only nondetections at well  
11 HP603?

12 A That's correct.

13 Q Okay.

14 A But again, you are making the mistake of  
15 comparing point values at a point in time and a  
16 point in space with the overall calibration of a  
17 model.

18 Q Uh-huh.

19 A You are confused in that.

20 Q Can we go to page A81?

21 A A81?

22 Q Yup. So same -- same exhibit.

23 A Okay.

24 MR. DEAN: Oh, A.

25 MS. O'LEARY: A, yeah.

1           A        A81?

2       BY MS. O'LEARY:

3           Q        Yeah.  And the --

4                       MR. DEAN:  A81.

5       BY MS. O'LEARY:

6           Q        -- column on the left --

7           A        Yeah.

8           Q        -- and as I send [sic] this -- the first  
9       sentence starts, "As previously discussed."

10                   But, "Simulated results for water supply  
11       well HP602 provide reasonable agreement with field  
12       data, whereas simulated results for water supply  
13       well HP603 are inconsistent with field data.  
14       Therefore, sensitivity analyses were conducted to  
15       assess the effect of varying contaminant, source,  
16       area, size, location, and release date on  
17       reconstructed benzene concentrations at water supply  
18       well HP603 and at the HP water treatment plant.

19                   "Additionally, the sensitivity analysis  
20       included assessing the effect of the contribution of  
21       benzene contaminated groundwater from well HP603 on  
22       benzene concentrations in finished water at the  
23       Hadnot Point water treatment plant."

24                   Now, were you involved in this  
25       sensitivity analysis on HP603?

1 A Yes, I was.

2 Q Okay. Am I understanding from what I  
3 just read on A81 that the ATSDR recognized the  
4 simulated results for water supply well HP603 as  
5 inconsistent with field data?

6 A That's what it says, yeah.

7 Q Okay. And still on --

8 A We established that --

9 Q Uh-huh.

10 A -- in our prior discussion.

11 Q And if you go onto the next page, just  
12 A82, there's a description of a -- of the  
13 sensitivity analysis that was done.

14 And am I correct in understanding that in  
15 the sensitivity analysis, they determined that  
16 varying the source concentrations caused only small  
17 improvement at --

18 A A- --

19 Q -- while 603 --

20 A -- -83 is only figures and you are --

21 Q A --

22 A -- referring to --

23 (Whereupon, the court reporter  
24 requests clarification)

25 A A -- A83 is only page for figures. You

1 are actually referring to A -- A82.

2 BY MS. O'LEARY:

3 Q A 82.

4 A Okay.

5 Q Yeah.

6 A Okay.

7 Q At the top.

8 A Uh-huh.

9 Q I can read what it says.

10 It says, "Sensitivity analysis results  
11 for varying assigned source concentration value from  
12 a calibrated value of 17,000 micrograms per liter,  
13 and source release date from the calibrated release  
14 date of January 1st, 1964, are listed in table A25.  
15 These results indicate a small improvement in  
16 reconstructed benzene concentrations while HP603  
17 compared to calibrated results."

18 So am I correctly understanding that the  
19 sensitivity analysis found only small improvement in  
20 HP603 by varying source concentrations?

21 A The sensitivity analysis looks at the  
22 effect of the variations of a certain parameter on  
23 the results. So in this case, actually, we are  
24 changing the source concentrations to see if it has  
25 an effect on the 603 -- well 603.

1           And we are concluding that the change in  
2       source concentrations does not effect that much.

3           Q       Okay. And -- and going on after that, it  
4       says, "Perhaps more important however, in the  
5       context of the overall project, is that the effect  
6       of these contaminant source variations on finished  
7       water benzene concentrations at the HP water  
8       treatment plant is minimal."

9           Do you agree it's more important in the  
10      context of the overall water modeling project at  
11      Hadnot Point that the contaminant source variations  
12      of the sensitivity analys- -- analysis on finished  
13      water on benzene concentrations at the Hadnot Point  
14      water treatment plant is minimal?

15                   MR. DEAN: Object to the form of the  
16                   question.

17           A       Yeah.

18       BY MS. O'LEARY:

19           Q       Okay.

20           A       I think it says that, yes.

21           Q       And to -- and then its goes on to say,  
22       "To assess the contribution of reconstructed benzene  
23       contaminated groundwater from water supply well  
24       HP603 to finished water concentrations at the Hadnot  
25       Point water treatment plant, the mixing model

1 results were derived by removing the flow and  
2 contaminant mass contribution from well HP603.

3 And then it says "The reconstructed  
4 benzene concentration results shown in figure A36  
5 indicate that the contribution from benzene  
6 contaminated water supply well HP603 to finished  
7 water concentrations at the HP water treatment plant  
8 was minimal."

9 And then --

10 A Yeah.

11 Q Do you agree?

12 A What -- yeah.

13 What we are saying is if we change the  
14 source date it has also minimal effect.

15 Q Okay. And if -- if HP603 does not have a  
16 big effect on the water treatment plant calibration,  
17 then does that mean that the calibrated model is  
18 drawing most of the benzene from different wells?

19 A Not the calibrated model. The water  
20 treatment plant is receiving contaminants from  
21 different wells, yeah.

22 Q Right.

23 A Yeah.

24 Q So if -- if -- so the specific well,  
25 HP603, has a changing source loading on that well

1 has a minimal effect on the water treatment plant  
2 levels, then does that mean in the model the source  
3 of the benzene is primarily other wells, not 603?

4 A No, that -- that's not what it says.

5 It says changes in the source value  
6 doesn't effect the water treatment plant  
7 concentrations. It doesn't say that the source at  
8 this well doesn't effect.

9 Q Well, isn't that what they varied, was  
10 the strength of the source at 603?

11 A No. There is a source. Let's --

12 Q Sure.

13 A -- say a hundred milligrams per liter,  
14 that's going to water treatment plant.

15 Now, if you make it 110 or 90, it doesn't  
16 make any change on the water treatment plant. But  
17 there is still hundred milligrams of contaminant in  
18 that --

19 Q Uh-huh.

20 A -- well.

21 Okay? I mean, the changing effects is  
22 not important but the source is still there,  
23 whatever it is.

24 Q Isn't the uncertainty analysis to see  
25 what happens when you vary the source strength?

1           A       Yeah. But you are asking me if you take  
2 the 603 out --

3           Q       Yeah.

4           A       -- it's not going to change the water  
5 too. That's not true.

6                   What I'm trying to tell you is there's a  
7 source which contributes to water treatment plant  
8 concentrations. A hundred milligrams, maybe ten  
9 milligrams of it goes to water treatment plant.

10          Q       Uh-huh.

11          A       Now, if you make the source or change the  
12 source value to 120 or 80, still ten goes to the  
13 water treatment plant.

14                   Conclusion is not if you take 603 out,  
15 still there's no change in the water treatment  
16 plant. No.

17                   Ten milligrams you are taking out now  
18 from the water treatment plant by taking out 603  
19 totally.

20          Q       Okay. You can set aside chapter A and we  
21 are going to go back to supplement six, which was  
22 Exhibit 11.

23          A       Exhibit 11.

24          Q       And to page S645.

25                   Actually, to -- yeah. S645, that's



1 correct.

2 A Okay.

3 Q Okay. So in the column on the right, the  
4 second paragraph begins, "For contaminant fate and  
5 transport modeling reported herein. However  
6 insufficient -- however insufficient water quality  
7 data existed to conduct a statistical analysis for  
8 assessment of model calibration fit. In addition,  
9 specific data pertinent to the timing of initial  
10 deposition of the contaminants in the ground or  
11 subsurface chronologies of waste disposal  
12 operations, such as dates and times when  
13 contaminants were deposited in the HPLF or  
14 descriptions of the temporal variation in  
15 contaminant concentrations in the subsurface  
16 generally are not available.

17 It goes on, "Determining these types of  
18 source identification and characterization data  
19 became part of the historical reconstruction process  
20 whereby the contaminant fate and transport model was  
21 used to test source locations, varying  
22 concentrations, and beginning and ending dates for  
23 leakage and migration of source contaminants to the  
24 subsurface and underlying groundwater flow system."

25 Were you involved in that process of

1 determining the types of source identification and  
2 characterization data?

3 A No. I'm not an author on this report so  
4 I wouldn't know what is the procedure -- what are  
5 the procedures they have used and I don't  
6 remember --

7 Q Okay.

8 A -- this paragraph.

9 Q Okay. And were you involved in the  
10 process of testing source locations by varying  
11 concentrations and beginning and ending dates?

12 A That -- this is -- let's see. In the  
13 landfill area.

14 We referred to that earlier in one of the  
15 other exhibits that we tested the start and ending  
16 dates of the wells. It didn't have any effect. We  
17 tested the source concentration magnitudes, it  
18 didn't effect.

19 So is this the same well or is this a  
20 different site? I -- I have no idea what we are  
21 talking about.

22 Q I mean, this chapter is about all of the  
23 wells.

24 A The previous --

25 Q At Hadnot Point.

1           A       -- chapter was on benzene application  
2       only?  Is that what we discussed a minute ago?

3           Q       So we were talking about chapter A, which  
4       is the summary of findings and chapter C, which is  
5       about occurrence of all --

6           A       No -- no.

7           Q       -- contaminants.

8           A       We were looking at some figures that  
9       nondetects were used or not used and we were talking  
10      about sensitivity analysis we used, just to see if  
11      the source concentration changed or if the time of  
12      application of the contaminant at the site changes.  
13      It didn't change anything.

14                 So you ask me the question, if you take  
15      this well off will there be any change in the water  
16      treatment plant?

17                 I answered the question as, "yes."

18                 Now we are coming to this supplement --

19           Q       To supplement six.

20           A       -- six.

21                 Is this -- I -- I'm not familiar with  
22      this chapter.  I haven't authored it.

23                 Are these paragraphs referring to what we  
24      have discussed a minute ago, which I have  
25      summarized?

1 Do you know that or --

2 Q I don't know.

3 A I don't know it either.

4 Q Okay.

5 A So --

6 Q Are you offering opinions about the  
7 calibration assessment of Hadnot Point?

8 A I'm offering opinions on a paragraph that  
9 you wrote or read -- read on this chapter.

10 Q So supplement six is called,  
11 "Characterization and simulation of fate and  
12 transport of selected volatile organic compounds in  
13 the vicinities of the Hadnot Point industrial area  
14 and landfilll."

15 Were you involved in any of those  
16 processes?

17 A No. I'm not an author on this report so  
18 I have no idea what's in this report.

19 Q Okay. So are you offering no opinions on  
20 anything contained in supplement six?

21 MR. DEAN: Object to the form.

22 A If I'm not an author the only thing I  
23 did, probably, I reviewed it.

24 BY MS. O'LEARY:

25 Q Okay. Are you offering any opinions

1 about mass loading at Hadnot Point?

2 A At certain sites I'm looking at benzene  
3 mass loadings that I have described a minute ago  
4 that it did effect it didn't effect and so forth.  
5 So I have an opinion on that but I don't have an  
6 opinion on this supplement six.

7 Q On benzene, let's start there. Were you  
8 involved in -- are you offering opinions, I mean, on  
9 the appropriateness of the calibrated value --

10 A Yeah.

11 Q -- for mass loading?

12 A Yeah. That study -- benzene study was  
13 done with TechFlowMP.

14 Q Okay. Are you offering opinions about  
15 the quality of the calibrated values of mass loading  
16 of the other contaminants at Hadnot Point?

17 A If my -- if -- if that is a study which I  
18 have done and I was involved in writing the report,  
19 yes, I'm going to offer an opinion on it. But the  
20 reference, the Exhibit 11 is written by some other  
21 group at ATSDR.

22 I'm not the author so I'm not going to  
23 offer an opinion on that.

24 Q If we stay on supplement six and page  
25 S645, where we were, still in the column on the

1 right --

2 A Six. Just a moment.

3 Exhibit six or --

4 Q No. It's Exhibit 11.

5 A Yes.

6 Q What we were on.

7 A And you are going back to the --

8 Q -- to S6.

9 A -- supplement that I'm not an author, I'm  
10 not an involved participant. Maybe I have just  
11 reviewed it and you are going to ask me a  
12 question --

13 Q Yes --

14 A -- about it again.

15 Q -- I have questions about it --

16 A Okay.

17 Q -- about S640.45.

18 So it said --

19 A 645?

20 Q Yeah. The column on the right --

21 A Yeah.

22 Q -- the third paragraph says, "Conducting  
23 a robust uncertainty analysis using Monte Carlo  
24 analysis requires simulating thousands of  
25 realizations. When using available computational

1 equipment, the HPIA and HPLF models have a  
2 simulation time of about six to eight hours for each  
3 simulation. The lengthy simulation times and the  
4 substantial data limitations therefore make a  
5 comprehensive uncertainty analysis computationally  
6 prohibitive based on available resources and time  
7 limitations. Thus the ranges values presented in  
8 the sensitivity analysis section of this report  
9 assess a limited number of input and output model  
10 parameter.

11 "The results, i.e. range of concentration  
12 presented in the sensitivity analysis reported  
13 herein should not be considered or interpreted as  
14 the results of a robust and comprehensive  
15 uncertainty analysis but do provide insight into  
16 parameters, sensitivity, and uncertainty in a  
17 qualitative sense."

18 Were you involved at all in an  
19 uncertainty analysis at Hadnot Point using Monte  
20 Carlo analysis?

21 A Yes. Not on this supplement though, on  
22 other applications, in other locations, in Tarawa  
23 Terrace, in benzene analysis. Yes.

24 Q But in Hadnot Point were you involved in  
25 an uncertainty analysis using Monte Carlo analysis?

1 A In other sites, yes.

2 Q What sites?

3 A What sites?

4 Q Yeah.

5 A Fuel farm, under storage tanks, benzene  
6 leakage, modeling of benzene using TechFlowMP. If I  
7 did the modeling I did the uncertainty analysis.

8 And I don't know what this is doing or  
9 what is this all about that we are looking at right  
10 now. I don't know that.

11 Q Can you go back one page --

12 A Uh-huh.

13 Q -- to S6.44?

14 A Yeah.

15 Q And there's a figure S6.23.

16 A Yes.

17 Q It says, "It's variations and  
18 reconstructed are simulated finished water  
19 concentrations of trichloroethylene derived using  
20 Latin hypercube sampling methodology on water supply  
21 well monthly operational schedules Hadnot Point  
22 water treatment plant, Hadnot Point-Holcomb  
23 Boulevard study area."

24 Do you see that?

25 A Yes, I see that.



1 Q And were you involved in the --

2 A I wasn't --

3 Q -- in this process?

4 A I wasn't involved in anything that you  
5 are showing me in this report, supplement six.

6 Q So -- so Professor Aral, you've told me  
7 that you weren't involved in supplement six but you  
8 were involved in Monte Carlo simulations at other  
9 areas of Hadnot Point.

10 This is where Monte Carlo simulations of  
11 from Hadnot Point are --

12 A I'm not the only --

13 Q -- report -- are reported --

14 A I'm not the only person who can do Monte  
15 Carlo analysis. Other teams within ATSDR can do  
16 that too.

17 Q Right. But --

18 A So at different sites we took the tasks  
19 onto us to do the simulations and then do the  
20 uncertainty analysis.

21 In this task, whatever this is, this is  
22 done by some other group. Anybody can do  
23 uncertainty analysis.

24 Q Sure.

25 A Yeah.

1 Q I don't disagree with you.

2 But the ones reported by the ATSDR are  
3 here in chapter A, supplement six. So where are the  
4 Monte Carlo simulations that you did on Hadnot  
5 Point? Where are they -- they reported?

6 A I have not done supplement six  
7 uncertainty analysis. Wherever this site is,  
8 whoever was responsible doing this simulation who  
9 did the analysis is not my group.

10 Q No, I understand that.

11 So where are the -- the simulations you  
12 did reported?

13 A Well, we -- we had done the benzene  
14 analysis --

15 Q Sure.

16 A -- there's a chapter on that. We did the  
17 simulations on underground storage tanks, there's a  
18 chapter on that. If we made the simulation, we are  
19 responsible of the sense -- uncertainty analysis  
20 associated with that.

21 If you -- if you want to go back to those  
22 chapters, I can answer all your questions.

23 Q Were you involved in the sensitivity or  
24 uncertainty analysis other than the benzene and the  
25 underground storage tanks?

1           A           If -- I don't remember all the tasks that  
2       I was involved with. But if you find a report which  
3       does a simulation analysis at the different site and  
4       my name is not on the report, I have not done that  
5       study.

6           Q           Okay. So you can set aside exhibit 11.

7           A           Okay.

8           Q           And I have a few questions about your --  
9       the timeline of your involvement in the ATSDR water  
10      models and their reviews by various entities.

11          A           Yeah.

12          Q           So we've already talked about how you  
13      started working with ATSDR with a cooperative  
14      agreement with MESL --

15          A           Right.

16          Q           -- around 2000.

17          A           Right.

18          Q           And then you've already mentioned that  
19      there was the expert panel in 2005 that the ATSDR --

20          A           That's correct.

21          Q           -- convened.

22                      Is that right?

23                               (Whereupon, the court reporter  
24                               requests clarification.)  
25

1 BY MS. O'LEARY:

2 Q "Convened."

3 And at that ATSDR panel, did you know any  
4 of the panel members before it was convened?

5 A Can you read the names?

6 Q Yeah.

7 Barry Johnson (phonetic), Robert Clark  
8 (phonetic), David Dougherty (phonetic), Benjamin  
9 Harding (phonetic), Leonard Konikow, Eric Laball  
10 (phonetic), Peter Pomerank (phonetic), Vijay Singh  
11 (phonetic), James Uber (phonetic), and Thomas  
12 Walski.

13 A I know Vijay Singh. I know James Uber  
14 and I read papers from Konikow. Probably I read  
15 papers from other names that you just read --

16 Q Okay.

17 A -- but I don't know them, personally.

18 MS. O'LEARY: And can we grab 54, if  
19 we haven't already?

20 (Whereupon, Government's Exhibit Aral  
21 20, Expert Peer Review Panel  
22 Evaluating ATSDR's Water Modeling  
23 Activities In Support of the Current  
24 Study of Childhood Birth Defects and  
25 Cancer At U.S. Marine Corps Base Camp

1                   Lejeune, North Carolina, was marked  
2                   for identification.)

3       BY MS. O'LEARY:

4           Q       Professor Aral, here's --

5           A       Uh-huh.

6           Q       -- Exhibit 20.

7           A       Yeah.

8           Q       And this is -- says it's the "Expert peer  
9       review panel evaluating ATSDR's water modeling  
10      activities in support of the current study of  
11      childhood birth defects and cancer at U.S. Marine  
12      Corps Base Camp Lejeune, North Carolina."

13                   And have you -- have you seen this  
14      development before?

15          A       Most probably, yes.

16          Q       Is this the report that came out after  
17      the expert review panel in 2005?

18          A       I presume, yes.

19          Q       Okay. I'd like to turn your attention  
20      first to page 20 -- well, I guess it's page 29.

21          A       Seventy-nine?

22          Q       Twenty-nine.

23          A       Twenty-nine.

24          Q       In section --

25          A       Yes.

1 Q -- section --

2 A Summary of recommendations.

3 Q Yeah. In section 6.4.

4 A Okay.

5 Q And they -- so 6.4 says, "Data analysis,  
6 Hadnot Point area."

7 Oh, sorry. Can we go back to 20 -- page  
8 29, 6.2 chronology of events?

9 A Okay.

10 Q Okay. So in that section it's: "The  
11 panel members recommended that ATSDR focus its next  
12 efforts on refining its understanding of  
13 chronological events. These need to include  
14 documenting periods of known contamination times  
15 when water distribution systems were interconnected  
16 and the start of operations at the Holcomb Boulevard  
17 water treatment plant."

18 So my understanding, this was a  
19 recommendation of the expert panel.

20 A Yes.

21 Q And did the ATSDR follow up on this  
22 recommendation to refine its understanding of  
23 chronological events?

24 A I think the answer is yes. And I think  
25 we also developed a specific application to look

1 into the interconnectedness of the two water  
2 treatment plants or --

3 Q Uh-huh.

4 A -- systems. We used the Markov chain  
5 analysis at that time.

6 MS. O'LEARY: And you can set this  
7 one aside.

8 Have we used one yet?

9 (Whereupon, the court reporter  
10 requests clarification.)

11 MS. O'LEARY: It was just a  
12 question, do we have one --

13 Exhibit 13. Would you grab Exhibit  
14 13?

15 (Whereupon, there was a discussion  
16 off the record.)

17 THE WITNESS: Exhibit 13?

18 MS. O'LEARY: I guess it's just a  
19 few pages.

20 BY MS. O'LEARY:

21 Q Is that it?

22 A Uh-huh.

23 Q Yeah. There you go.

24 A Uh-huh.

25 Q And this is the -- we looked at it

1 before -- but this is the transcript of that expert  
2 panel.

3 A Okay.

4 Q And can we go to page 20 of the  
5 transcript? So not of the document.

6 MS. BAUGHMAN: We only have --

7 MS. O'LEARY: Not of the document,  
8 of the transcript.

9 So it should say "20" in the top  
10 right corner.

11 THE WITNESS: Twenty?

12 I don't see a page 20.

13 MS. BAUGHMAN: We don't have 20.

14 MR. DEAN: We don't have 20.

15 MS. O'LEARY: Oh, you don't have a  
16 page 20?

17 MS. BAUGHMAN: No.

18 MS. O'LEARY: All right. Then never  
19 mind. We'll skip that one then.

20 MS. BAUGHMAN: You want to see?

21 It's the --

22 MS. HORAN: No, I believe you.

23 MS. O'LEARY: No, we believe you.

24 MS. BAUGHMAN: Okay.

25 MS. O'LEARY: Can we just --



1 MR. DEAN: Let me see that?

2 MS. HORAN: We believe you.

3 MR. DEAN: Oh, I was just giving  
4 back to --

5 MS. HORAN: I'll look but we believe  
6 you.

7 MR. DEAN: I was just giving it back  
8 to you in case you wanted to reuse this.

9 MS. HORAN: What?

10 MS. O'LEARY: Can we go back then to  
11 54, which is the one that we had before.  
12 It's got this tan cover.

13 THE WITNESS: Okay.

14 MS. BAUGHMAN: Is that 13?

15 MS. HORAN: Yeah.

16 MR. DEAN: Okay.

17 MS. HORAN: He'll need it back.

18 MS. BAUGHMAN: What are we on now?  
19 What --

20 MS. O'LEARY: Well, we are pulling  
21 up this one, which is --

22 MS. HORAN: Exhibit 54 --  
23 Exhibit 20?

24 MS. O'LEARY: -- twenty.

25 THE WITNESS: Exhibit 20?

1 MS. BAUGHMAN: We are going back to  
2 Exhibit 20?

3 MS. HORAN: Yes.

4 MS. BAUGHMAN: All right. The last  
5 one?

6 MS. HORAN: Yes.

7 MS. BAUGHMAN: What page?

8 MS. O'LEARY: We'll be heading for  
9 page --

10 THE WITNESS: Oh, my God.

11 MS. O'LEARY: -- 121.

12 THE WITNESS: Wait a minute.

13 MS. O'LEARY: Oh, there it is.

14 THE WITNESS: Yeah.

15 MS. O'LEARY: That's it.

16 THE WITNESS: 121?

17 MS. O'LEARY: Page 121.

18 MS. BAUGHMAN: Is this Exhibit 20?

19 MS. HORAN: It should be.

20 THE WITNESS: Page 121?

21 MS. BAUGHMAN: Yeah, but there's no  
22 page 121.

23 THE WITNESS: There's no such --

24 MS. BAUGHMAN: There's no --

25 MS. O'LEARY: Oh, it's section -- I

1 think that's the document number.

2 So it's section two point -- or  
3 4.2.4, which will be --

4 THE WITNESS: Four point two point  
5 four.

6 MS. O'LEARY: There we go.  
7 So that will be page 21.

8 THE WITNESS: Page 21. Okay.  
9 Okay.

10 BY MS. O'LEARY:

11 Q And this -- so there's a section 4.2.4,  
12 suggested modeling approaches, modifications and  
13 considerations.

14 And in the section on groundwater, kind  
15 of in the middle there's a paragraph that begins  
16 "Dr. Walski."

17 Do you see that?

18 A Yup.

19 Q Can you read that paragraph?

20 A "Dr. Walski suggested performing an  
21 overall classification of the areas where  
22 contamination was known to occur and the areas  
23 without contamination. People in the contaminated  
24 areas will be considered exposed and those in the  
25 uncontaminated areas will be classified as

1 unexposed.

2 "He's also recommending -- he also  
3 recommended that ATSDR use modeling to concen- --  
4 concentrate on the areas where contamination and  
5 exposure are known. As a next step, he recommended  
6 ATSDR prepare a matrix to determine a timeframe when  
7 contamination did or did not occur."

8 Q Okay. So at -- at the time of this  
9 expert panel in 2005, was ATSDR working primarily on  
10 Tarawa Terrace?

11 A Yeah.

12 Q And ATSDR did not ultimately decide on  
13 simpler classification systems like Dr. Walski  
14 described; is that correct?

15 MR. DEAN: Objection to the form.

16 A I think this recommendation on simple  
17 models were associated with the next phase which is  
18 Hadnot Point and Holcomb Boulevard -- Boulevard  
19 areas.

20 BY MS. O'LEARY:

21 Q Okay.

22 A Yeah.

23 Q Well, if we go down, the next line that  
24 says "Dr. Walski," so it's the last one on page  
25 21 --

1 A Yeah.

2 Q -- Exhibit 20.

3 It says "Dr. Walski considered the  
4 historical pattern of contamination at Hadnot Point  
5 too complex to model because the numerous sources  
6 cannot be correlated to particular wells."

7 A Yeah.

8 Q So why was that advice not taken by the  
9 ATSDR?

10 A It was. It was considered.

11 Q Well, but they did -- they did model  
12 Hadnot Point, didn't they?

13 A Yeah, they did. But they didn't model  
14 the whole Hadnot Point area as we did the Tarawa  
15 Terrace area. We did --

16 Q What do you mean --

17 A We did individual sections of it where  
18 there's a contamination of benzene. We looked at  
19 the sources. We just modeled that source  
20 propagation as the main parameter.

21 We looked at the landfill application  
22 separately.

23 Q Uh-huh.

24 A We used simpler models in there as well.  
25 So we -- we followed all these recommendations.

1 Q Does that mean in the Hadnot  
2 Point-Holcomb Boulevard area water model, the  
3 groundwater contaminant fate and transport don't  
4 cover the whole area, it's just --

5 A No. No.

6 Q -- localized?

7 A It covers -- the groundwater flow area is  
8 done for the -- done for the whole section of Hadnot  
9 Point Holcomb, Boulevard, etc., etc.

10 But when you introduce the contaminant  
11 transport over that, overlay it, you just look at  
12 the benzene concentrations where the source is, like  
13 underground storage wells or spillage that occurred  
14 in certain years, so you don't look at the benzene  
15 plus the landfill area TCE concentrations at the  
16 same time.

17 So different applications at different  
18 sections of the model region was considered.

19 Q Okay. And then I have questions for you  
20 about the natural resource --

21 A Uh-huh.

22 Q -- the NRC, the National --

23 A Right.

24 Q -- Academy of Sciences --

25 A Right.

1 Q -- National Resource Council --

2 A Right.

3 Q -- because they under -- they published a  
4 report on the Camp Lejeune water studies; correct?

5 A That's correct.

6 Q And you talked about those in your expert  
7 report --

8 A Yes.

9 Q -- in this case; right?

10 A Yes, that's correct.

11 MS. O'LEARY: Let me grab that  
12 report. It's five.

13 (Whereupon, Government's Exhibit Aral  
14 21, Report, was marked for  
15 identification.)

16 BY MS. O'LEARY:

17 Q Here is Government Exhibit 21, Professor  
18 Aral.

19 (Whereupon, there was a discussion  
20 off the record.)

21 BY MS. O'LEARY:

22 Q And Professor Aral, I'd like to go  
23 to what should be called page one.

24 This one starts with some Roman numerals  
25 before the main numbers.

1 A Page one?

2 Q Yup. Which is not -- not close to the  
3 first page.

4 A Oh.

5 Q It's in a little ways.

6 When you get there, it should say "Public  
7 summary and context" at the top.

8 A Yeah.

9 MS. BAUGHMAN: What page are we on?

10 MS. O'LEARY: It's page one, but  
11 that's quite a ways in.

12 It says, "Public summary and  
13 context" at the top.

14 THE WITNESS: Uh-huh.

15 MS. BOLTON: What's the ending Bates  
16 number?

17 MS. O'LEARY: Oh, yes. The ending  
18 Bates number is -452.

19 BY MR. DEAN:

20 Q So those little numbers on the bottom  
21 right.

22 A Yeah.

23 Q Okay. So in this page, it says the  
24 "Charge to the committee" --

25 A Uh-huh.



1           Q       It says, "The National Research Council  
2       conducted this review in response to a request from  
3       the U.S. Navy, the department under which the Marine  
4       Corps operates. The Navy was mandated by the U.S.  
5       Congress to request a review by the NRC to address  
6       the evidence on whether adverse health outcomes are  
7       associated with past contamination of the water  
8       supply at Camp Lejeune.

9                   "The NRC developed specific instructions  
10      for the scope of the review. It then rerecruited  
11      and appointed a committee of scientists with diverse  
12      but pertinent backgrounds and perspectives to carry  
13      out the review."

14                 Do you have any reason to think that's  
15      inaccurate?

16                   MR. DEAN: Object to the form of the  
17      question.

18           A       Can you repeat that?

19      BY MS. O'LEARY:

20           Q       Yeah.

21                 Do you have any reason to think that's  
22      inaccurate, that opening paragraph?

23                   MR. DEAN: Object to the form --

24           A       I think it's inaccurate.

25

1 BY MS. O'LEARY:

2 Q You think it's what?

3 A Inaccurate.

4 Q How is it inaccurate?

5 A It's inaccurate because they were asked  
6 to address the evidence on whether adverse health  
7 outcomes are associated with past contamination in  
8 water supply at Camp Lejeune. They only -- what  
9 they only did, they didn't do a study to address  
10 that, they only criticized the ATSDR work.

11 Q Do you agree that the Navy was mandated  
12 to request the review by the NRC?

13 A It says that. To request a review by the  
14 NRC to address the evidence on whether adverse  
15 health outcomes are associated with past  
16 contamination of the water supply at Camp Lejeune.

17 So they are asking NRC to do what ATSDR  
18 did in that request.

19 Q Right. And that was what was mandated by  
20 Congress.

21 A Yeah. But they didn't do that.

22 Q Okay.

23 A They only criticized the ATSDR water  
24 modeling work.

25 Q You don't think a critique is a -- is a

1 review?

2 A It's -- they are not asking for a -- oh,  
3 request a review to me implies that they reviewed  
4 the whole analysis, themselves.

5 Q Okay. If you -- I want to turn,  
6 actually, to your report, which is --

7 MS. HORAN: Two.

8 BY MS. O'LEARY:

9 Q -- two, Exhibit 2.

10 A Exhibit 2?

11 Q Yes.

12 A Exhibit 2, Exhibit 2, Exhibit 2 --  
13 Exhibit 8, Exhibit 7, 11, 17...

14 Q And I want to go to page 12, which we  
15 looked at --

16 A So let me first find this.

17 Q Oh, sorry.

18 A The --

19 Q Is that it there on the right, on that  
20 stack? Oh, no. It's not -- that's not the marked  
21 one.

22 Here it is, Professor Aral --

23 A Okay.

24 Q -- it's right here.

25 A Yup.

1 Q So to page 12.

2 Okay. So this is that bullet-pointed  
3 list that we've seen before.

4 And the last bullet point, where you say,  
5 "The model results show finished water at" -- excuse  
6 me.

7 Not the last bullet point, the second to  
8 last bullet point.

9 It says, "The models and techniques used  
10 by ATSDR for historical con- -- reconstruction  
11 including fundamental equations, input parameters,  
12 parameter estimates, calibration uncertainty, and  
13 sensitivity analyses were and remain reliable,  
14 scientifically valid, and state of the art  
15 procedures that are consistent with standard  
16 practices used and are generally accepted in this  
17 field."

18 What does it mean for the simulated --  
19 or -- no.

20 What does it mean for these to be  
21 mathematically reliable, statistically accurate, and  
22 correct?

23 A That means the models that we are using  
24 or used, like the ones that we have developed at  
25 Georgia Tech, are mathematically correct. Meaning

1 the procedures that we define in mathematical terms  
2 are correctly transported into a mathematical model  
3 application without an error.

4 Statistically correct means the  
5 application results provide estimates of uncertainty  
6 analysis as well and the deterministic results that  
7 we are predicting is within the bounds of that  
8 uncertainty analysis.

9 Q Okay.

10 MS. O'LEARY: And I just need a few  
11 minutes break. Can we take a break right  
12 here?

13 THE WITNESS: Okay.

14 MS. O'LEARY: I need about ten  
15 minutes.

16 THE VIDEOGRAPHER: The time right  
17 now is 4:30 p.m. We are off the record.

18 (Whereupon, there was a recess taken  
19 from 4:30 p.m. to 4:41 p.m.)

20 THE VIDEOGRAPHER: The time right  
21 now is 4:41 p.m. We are back on the  
22 record.

23 THE WITNESS: Okay.

24 BY MS. O'LEARY:

25 Q Thank you, Professor Aral. So if you can

1 stay looking at your report, which was Exhibit 2 --

2 A Yes.

3 Q -- Government Exhibit 2, and go to page  
4 13 --

5 A Yes.

6 Q -- where that bulleted list continues?

7 A Uh-huh.

8 Q So the first item on that -- on page 13  
9 says, "The simulated monthly mean concentrations of  
10 TCE, PCE, 1,2-TDCE, benzene, and vinyl chloride at  
11 Tarawa Terrace, Hadnot Point, and Holcomb Boulevard  
12 included tabulated or in figures in ATSDR reports  
13 are reliable and represent, within a reasonable  
14 degree of scientific and engineering certainty, the  
15 contaminant levels in finished water at Camp Lejeune  
16 from 1953 to 1987."

17 MR. DEAN: Okay.

18 BY MS. O'LEARY:

19 Q What is that reasonable degree of  
20 scientific and engineering certainty for the monthly  
21 mean concentrations?

22 A That's -- that would be probably best  
23 described with the deterministic results being in  
24 between the uncertainty bounds of the application.

25 Q How does that relate to their reliability

1 to what the actual historical values were?

2 A Reliability --

3 MR. DEAN: Object to form.

4 A What -- what do you mean by reliability?

5 BY MS. O'LEARY:

6 Q So the simulated monthly mean  
7 concentrations for TCE, PCE, DCE, benzene --

8 A Uh-huh.

9 Q -- and vinyl chloride at Tarawa Terrace,  
10 Hadnot Point, and Holcomb Boulevard what is -- do  
11 you have an opinion on how close those values are to  
12 the historical values they are trying to estimate?

13 A Yeah.

14 MR. DEAN: Object. Object to form.

15 A Uh-huh. I looked at the final results  
16 on -- on uncertainty analysis and the mean values.  
17 I -- we can notice that at the initial phases of the  
18 simulation, the mean values are probably at the high  
19 side of the uncertainty band but between -- I don't  
20 remember exactly, but 1960s onward to 1980s -- '85,  
21 I think the mean values are right at the -- in the  
22 middle part of that uncertainty -- uncertainty  
23 band --

24 BY MS. O'LEARY:

25 Q Are the --

1 A -- so --

2 Q Are the simulated monthly mean  
3 concentrations within 10 percent of the unmeasured  
4 historical values?

5 MR. DEAN: Object to the form.

6 A Ten percent of historical values --

7 BY MS. O'LEARY:

8 Q Yeah.

9 A -- of what?

10 Q Of the contaminant concentrations.

11 That what the true monthly mean

12 contaminant concentrations were --

13 A In the --

14 Q -- are the simulated values within ten  
15 percent of those?

16 A In a --

17 MR. DEAN: Object to the form.

18 A In a statistical sense, if you look at it  
19 from a statistical distribution, the results are  
20 within less than ten percent of the --

21 BY MS. O'LEARY:

22 Q Within what statistical sense?

23 MS. BAUGHMAN: He's not finished.

24 BY MS. O'LEARY:

25 Q I'm sorry. Go ahead.



1           A           I'm -- I'm looking at the results that we  
2           are presenting within the uncertainty band and the  
3           mean deterministic results are lying just at the  
4           center of that uncertainty band.

5                       If you are asking how does the  
6           predictions go with the observed water treatment  
7           plant concentrations, there's a significant  
8           variation on that but statistically they are on  
9           target.

10          Q           I'm not asking about either of those.  
11          I'm asking about for the unmeasured historical mean  
12          concentrations --

13                       MR. DEAN: Object to form.

14          BY MS. O'LEARY:

15          Q           -- how close to those can you say that  
16          the simulated monthly mean values are?

17          A           Okay. What you are asking is, what is  
18          the accuracy or model prediction results in  
19          reference to historical contamination at the site --

20          Q           That's right.

21          A           -- during which we didn't have any data  
22          but we needed the data for the epi study, right?

23          Q           That's right.

24          A           Okay.

25                       There's no other way in mathematical

1 model done for the Camp Lejeune site which wrongly  
2 predicts that range but rightly predicts the water  
3 treatment plant. That cannot be developed.

4 Q I don't understand what you mean.

5 A That means the accuracy of the model  
6 within the range of the timeline where we don't have  
7 data --

8 Q Uh-huh.

9 A -- must be accurate so that we are  
10 getting to the right water distribution plant  
11 concentrations.

12 Q But don't -- don't you --

13 A That's -- that's, in a sense, what we  
14 call validation issue.

15 Q But aren't there multiple solutions to  
16 what the historical concentrations could have  
17 been --

18 A That's exact --

19 Q -- that arrive at the same  
20 concentrations --

21 A That --

22 Q -- that we actually know about in the  
23 80s?

24 A That's exactly what I'm saying.  
25 In the overall sense, you cannot develop

1 a model which totally shows a different trajectory  
2 starting from 1953, all the way to '85, totally  
3 different trajectory which matches with the water  
4 treatment plant concentrations at the level that we  
5 have matched.

6 There's continuity in groundwater flow.  
7 There's continuity in contaminant transport plume  
8 migration. If you are able to predict the future or  
9 present day concentrations --

10 Q Uh-huh.

11 A -- in 1987, all the other predictions  
12 dating back to 1953 must be correct or --

13 Q How correct?

14 MR. DEAN: Object to the form.

15 A How correct?

16 Statistically, that's the most rated in  
17 the uncertainty ranges associated with the  
18 variations that may be included into the model  
19 predictions which probably are referring to. And  
20 all of that is within the uncertainty bound.

21 BY MS. O'LEARY:

22 Q But you said you were not involved in  
23 chapter I, which had the analysis of much of the  
24 uncertainty in Hadnot Point.

25 A I'm only referring to the -- not much of

1 the -- I'm only referring to the work that we have  
2 done at Tarawa Terrace, the benzene concentration,  
3 landfill application, and the industrial -- not the  
4 industrial -- underground storage tanks, which we  
5 did.

6 Similar procedures, similar mathematical  
7 techniques are used by other groups within ATSDR, so  
8 they followed the correct procedures. And what I  
9 say to my work applies to them as well.

10 Q So you think that the solution that is  
11 the calibrated model for Tarawa Terrace is the  
12 uniquely best one?

13 A It is unique in the sense that you cannot  
14 produce a totally different trajectory of  
15 contaminant movement in the aquifers of Camp Lejeune  
16 Tarawa Terrace --

17 Q Uh-huh.

18 A -- which ends up consistently with the  
19 results that we have predicted.

20 Q What does totally different mean though?  
21 You said totally different.

22 A Totally mean -- for example, you would  
23 like to see the results being less than MCL levels  
24 in the Tarawa Terrace area throughout the region of  
25 the timeline of the study like an exponential curve

1 going up and reaching, finally, the water treatment  
2 plant concentrations. That's totally different,  
3 right?

4 Q So are you -- you are referring to the  
5 overall shape --

6 A Yup.

7 Q -- of the curve?

8 A Overall shape.

9 Q That the overall shape can't be totally  
10 different?

11 A Cannot be totally different.

12 Q Okay. But it could be different just  
13 not totally --

14 A It --

15 Q -- different?

16 A -- it will be different within the  
17 uncertainty bounds of the set statistical limits and  
18 the --

19 Q But that uncertainty bounds you've --  
20 you've acknowledged isn't the whole universe of what  
21 could have happened at --

22 A We are --

23 Q -- the site.

24 A -- modeling here. We are not doing the  
25 universe application. We are just doing a model of

1 the universe that you are having to describe in your  
2 mind.

3 Q Right. So I -- my question is how to  
4 relate the model to the reality it's trying to  
5 emulate. So in that frame --

6 A All models are approximations to the  
7 environment.

8 Q Uh-huh.

9 A If you all agree with the assumptions we  
10 made in building this model for Camp Lejeune, we  
11 have to agree with the results of the model because  
12 there are no mathematical errors in there, there are  
13 no statistical errors in that analysis. And if the  
14 model assumptions are correct, if they are properly  
15 describing the environment approximately --

16 Q Uh-huh.

17 A -- then the results are correct.

18 Q But what if they don't appropriately --

19 MR. DEAN: Object --

20 BY MS. O'LEARY:

21 Q -- describe the environment of the model?

22 A Then you have --

23 MR. DEAN: Object to the form.

24 A -- the wrong model --

25

1 BY MS. O'LEARY:

2 Q Then you have the wrong model?

3 A -- in your hand.

4 Yeah, if you -- if you can prove that to  
5 us, we will accept the mistake.

6 Q Okay. Moving on from specific modeling  
7 questions, just to confirm: Did you do any water  
8 modeling at the rifle range, Camp Geiger, Marine  
9 Corps Air Station New River, Montfort Point which is  
10 also called Camp Johnson, Courthouse Bay, or Onslow  
11 Beach water distribution systems at Camp Lejeune?

12 A No.

13 Q Okay. And your report does not contain  
14 opinions about contamination in water coming from  
15 those water systems treatment plants; is that  
16 correct?

17 A That's correct.

18 Q And do you have an understanding of why  
19 no water modeling was done at rifle range, Camp  
20 Geiger, Marine Corps Air Station, New River,  
21 Montfort Point, Camp Johnson, Courthouse Bay, or  
22 Onslow Beach?

23 A I was not involved in that decision.

24 Q Okay. And I have another question about  
25 your report. It's on page 12. So near where we

1 were, just one page back, page 12.

2 A Page 12?

3 Q Yes.

4 A Uh-huh.

5 Q Right in -- near the top, in the 4.1  
6 water modeling section.

7 A Right.

8 Q The second sentence says, "The use of  
9 modeling for historical reconstruction is an  
10 accepted methodology to predict past exposure or  
11 contamination levels as demonstrated both in the  
12 scientific literature." And then there are some  
13 citations. "And in site-specific studies, such as  
14 Jacksonville, Florida Naval Air Station, Tucson  
15 International Airport/Hughes Aircraft Facility,  
16 Oakridge National Lab, Hanford Site, and Toms River  
17 Dover Township."

18 A Yes.

19 Q I want to explore what you mean by a  
20 historical reconstruction being an accepted  
21 methodology within -- to predict past exposure to  
22 contamination levels and how it compares to what was  
23 done at Camp Lejeune.

24 MS. O'LEARY: So can we look at 52,  
25 please?



1                   This will end up being Government  
2                   Exhibit 22.

3                   (Whereupon, Government's Exhibit Aral  
4                   22, Independent Reviewer Comments  
5                   Document, was marked for  
6                   identification.)

7                   MS. O'LEARY:   Here you go.

8                   THE WITNESS:   Uh-huh.

9                   BY MS. O'LEARY:

10                  Q           Twenty-two is a document, it goes onto  
11                  two pages.   And the label is, "Independent reviewer  
12                  comments."

13                               And this isn't on here but I'll represent  
14                  to you that the time name of this document within  
15                  materials from the ATSDR was,  
16                  "Aral\_resp\_document\_2011-05-05\_BallockM.docs"  
17                  (phonetic).

18                  A           Wait.   Wait.   I -- this is the first time  
19                  I'm seeing this, I think.

20                               What is this?

21                  Q           Well, that was my question for you.

22                               The file name had your name in it.   It  
23                  said it was, "Aral resp document," and then the date  
24                  and then "Bollock M."

25                  A           Is -- is that name on this paper?

1 Q No, it was in the file name --

2 A Oh, the file name.

3 Q -- that this document came from.

4 And so I wondered, do you know who  
5 "Mansour Ballock ORISE fellow hydrologist" is?  
6 That's near the top in the name and title of  
7 reviewer.

8 A "Monsour Ballock," I don't know this  
9 name.

10 Q Okay.

11 A No. I --

12 Q Have you ever seen this document --

13 A No.

14 Q -- before?

15 A No.

16 Q Okay. You can --

17 A No.

18 Q -- set it aside.

19 MS. O'LEARY: Then can we get 36.

20 (Whereupon, Government's Exhibit Aral  
21 23, Historical Reconstruction of the  
22 Water Distribution System Serving the  
23 Dover Township Area, New Jersey,  
24 January 1962 to December 1996, was  
25 marked for identification.)

1 BY MS. O'LEARY:

2 Q Professor, it looks like this will end up  
3 as Government 23.

4 There you go.

5 So this document is -- title is  
6 "Historical Reconstruction of the Water Distribution  
7 System Serving the Dover Township Area, New  
8 Jersey" --

9 A Uh-huh.

10 Q -- "January 1962 to December 1996."

11 A Uh-huh.

12 Q And are you familiar with the document  
13 that's in Exhibit --

14 A Yes.

15 Q -- 23?

16 A Yes.

17 Q What is it?

18 A Yes.

19 It has my lab's logo on it.

20 Q Okay. And as I look at the -- I guess  
21 it's the third page, but it doesn't have a number --

22 A Okay.

23 Q -- but it -- it appears you are listed as  
24 an author.

25 A Uh-huh.

1 Q Is that correct?

2 Did you -- are you one of the authors of  
3 this document?

4 A Yeah.

5 Q Okay. And can you go to the page that  
6 has the little Roman numeral four? So little iv?

7 A Uh-huh.

8 Q So in the first paragraph in the column on  
9 the left, it -- it starts, in the last sentence,  
10 says, "In 1997, ATSDR and NJDHSS determined that an  
11 epidemiologic study was warranted and that the study  
12 would include assessments of the potential for  
13 exposure to specific drinking water sources. To  
14 assist the epidemiologic efforts, ATSDR developed a  
15 work plan to reconstruct historical characteristics  
16 of the water distribution system serving the Dover  
17 township area by using water distribution system  
18 modeling techniques.

19 "The numerical model chosen for this  
20 effort, EPA net two, is available in the public  
21 domain and is described in the scientific  
22 literature. To test the reliability of model  
23 simulations, water distribution system data specific  
24 to the Dover township area were needed to compare  
25 with model results. Lacking such data, a field data

1 collection effort was initiated to obtain pressure  
2 measurements, storage tank water levels, and system  
3 operation schedules during winter demand and peak  
4 demand operating conditions.

5 "Using these data, the water distribution  
6 system was -- model was calibrated to present day  
7 conditions. ATSDR released a report and a technical  
8 paper in June 2000 describing the field data  
9 collection activities and model calibration  
10 results."

11 Okay. So in looking in this, which is  
12 one -- this is one of the studies you cited in your  
13 report about --

14 A Yeah.

15 Q -- the established use of --

16 A Yeah.

17 Q -- of forecasting backwards --

18 A Yeah.

19 Q -- in -- in use of water models; is that  
20 correct?

21 A Yeah.

22 Q Am I understanding that in this study at  
23 Dover township area, the model involved was just the  
24 water distribution system?

25 Is that correct?

1 A That -- that's correct.

2 Q So there was no groundwater model in  
3 this --

4 A No.

5 Q -- is that correct?

6 A No.

7 Q And there --

8 A We were just using data from pumping  
9 wells.

10 Q Okay. And was there any contaminant fate  
11 and transport modeling?

12 A Yes.

13 Q What was the contaminant fate and --

14 A EPA --

15 Q -- transport --

16 A -- net --

17 Q -- model?

18 A -- two. Contaminant fate and transport  
19 in the pipelines, not in the groundwater.

20 Q Okay. So was there a contaminant fate  
21 and transport model in the groundwater?

22 A There wasn't any groundwater --

23 Q There --

24 A -- contaminant transport. But there was  
25 contaminant transport analysis in the pipelines.

1 Q Okay. So within the distribution system?

2 A Yes.

3 Q Okay. And then the next paragraph, still  
4 on iv, it says, "Having established the reliability  
5 of the model and the modeling approach, the model  
6 was used to examine or reconstruct plausible  
7 historical characteristics of the water distribution  
8 system. For this purpose, monthly simulations were  
9 conducted between January 1962 through December 1996  
10 to estimate the proportionate contribution of water  
11 from points of entry well or well fields to various  
12 locations throughout the Dover township area."

13 A Yes.

14 Q So do you agree that the results from the  
15 Dover township model were a proportionate  
16 contribution and not a contaminant concentration?

17 A Oh, as you know, the contaminant loss  
18 within a pipeline system is always negligible. So  
19 if you put a concentration of one -- at a certain  
20 point -- milligrams per liter, it doesn't matter  
21 whether you put 200 milligrams per liter, it's  
22 proportionate. The results can be always extended  
23 to another concentration level.

24 Q But what was reported in the Dover  
25 township study --

1 A Is a character --

2 Q -- was the proportionate contribution --

3 A Yeah.

4 Q -- right?

5 A Exactly.

6 Q Okay. So the proportionate contribution  
7 of a particular well?

8 A Yeah. Yeah.

9 Q Okay.

10 A Which sites of the water distribution  
11 system received contaminants from which well.

12 Q Okay. In the Dover township study, am I  
13 correct that that did not include any contaminant  
14 mass loading modeling?

15 A No. No.

16 Q It --

17 A Whatever --

18 Q Meaning it did not include that?

19 A No, it did not.

20 It just looked at the -- how the water  
21 coming from wells are distributed in the water  
22 distribution system.

23 Q Okay. And did it involve -- it -- sorry.

24 It did not involve contaminant  
25 biodegradation --



1 A No.

2 Q -- modeling.

3 A No. I don't think so.

4 Q Okay. And were there fewer than ten well  
5 fields involved --

6 A I -- I --

7 Q -- in that model?

8 A -- have to read the report to answer that  
9 honestly.

10 Q Okay. And did it involve modeling  
11 anything outside of the distribution system?

12 A No.

13 Q Okay. That's all I wanted to ask you  
14 about this one.

15 A Okay.

16 MS. O'LEARY: And can we get 64?  
17 (Whereupon, Government's Exhibit Aral  
18 24, USGS Water Resources  
19 Investigations Report, was marked for  
20 identification.)

21 BY MS. O'LEARY:

22 Q Professor Aral, this will be Government  
23 Exhibit 24.

24 And -- so Professor Aral, the document --  
25 or Exhibit 24 says it's the "Fate and transport

1 modeling of selected chlorinated organic compounds  
2 at hangar 1,000, U.S. Naval Air Station  
3 Jacksonville, Florida." And it says it's by the  
4 USGS Water Resources investigations report and it  
5 has its number.

6 A Uh-huh.

7 Q Is this the report you were discussing in  
8 your --

9 A Yes.

10 Q -- report when you said --

11 A I think so.

12 Q -- when you mentioned the Jacksonville  
13 Naval Air Station?

14 A That's correct.

15 Q Okay. And can you go to page two of this  
16 report, which is a few pages in?

17 A Uh-huh.

18 Q There's a section called, "Purpose and  
19 scope," in the right-hand column.

20 A Uh-huh.

21 Q And it says, "A computer model capable of  
22 simulating the groundwater flow and the fate and  
23 transport of trichloroethylene, dichloroethylene,  
24 and vinyl chloride in the groundwater at hanger  
25 100 -- 1,000 was needed by the Navy to aid in

1 remedial decisions.

2 "The purpose of this report is to  
3 document the development of this model which  
4 simulates groundwater flow in solute transport and  
5 presents the results of the model predictions. The  
6 computer modeling effort consisted of one updating  
7 existing large scale groundwater model to simulate  
8 groundwater flow in the vicinity of hangar 1,000,  
9 establishing boundary conditions for a site specific  
10 model with the large scale model, and predicting the  
11 movement of contaminants at hangar 1,000 through  
12 solute transport simulation using the site specific  
13 model."

14 So do you agree that the purpose of this  
15 naval air station in Jacksonville modeling was to  
16 aid in remediation?

17 A Yeah.

18 Q And that is looking to the future? Like,  
19 using the present to look at what to do in the  
20 future, is that correct?

21 A I think it looked at the past  
22 contamination and how it spread over the region.  
23 If -- I don't recall exactly what it did look -- but  
24 it could have looked at the past contamination as  
25 well --

1 Q Oh.

2 A -- but the purpose was remediation.

3 Q Yeah. And I don't disagree about having  
4 looked at the past --

5 A Right.

6 Q -- but, I mean, the purpose was for --

7 A Yeah, yeah, yeah.

8 Q -- predicting what would happen --

9 A Yeah.

10 Q -- in the future.

11 A Exactly.

12 Q Correct?

13 That's the purpose on remediation, is --

14 A That's right.

15 Q -- where it's going, where should we  
16 clean up.

17 A Uh-huh. Uh-huh.

18 Q And still on -- or actually, if we could  
19 go to page 49?

20 A Uh-huh. Yes.

21 Q Okay. There's the column on the left on  
22 page 49, the second paragraph, it starts,  
23 "Simulation." "Does a simulated" -- oops, excuse  
24 me. I'm in the wrong spot. Huh.

25 Do you know what the time frame for the

1 running of the model on Jacksonville, Florida Naval  
2 Air Station was?

3 A I wouldn't know that.

4 Q Okay.

5 MS. O'LEARY: And that's all I  
6 wanted to ask you about that. If we  
7 could go to --

8 THE WITNESS: Okay.

9 MS. O'LEARY: -- thirty-one.

10 (Whereupon, Government's Exhibit Aral  
11 25, EPA Superfund Record of Decision,  
12 Tucson International Airport Area,  
13 Arizona, was marked for  
14 identification.)

15 BY MS. O'LEARY:

16 Q There you go --

17 A Thank you.

18 Q -- Professor Aral.

19 MS. O'LEARY: And what's the exhibit  
20 number? Is this 25?

21 MS. HORAN: That's right.

22 BY MS. O'LEARY:

23 Q Okay.

24 A Yeah.

25 Q So we've got Exhibit 25. It says it's

1 "EPA superfund record of decision, Tucson  
2 International Airport Area" --

3 A Yeah.

4 Q -- "Arizona."

5 Is this what you were citing in your  
6 report in one of the area -- examples of --

7 A Uh-huh.

8 Q -- the use of --

9 MR. DEAN: Objection.

10 BY MS. O'LEARY:

11 Q -- historical water modeling?

12 A This -- this is -- if I recall this  
13 correctly, this is a site where site data was -- was  
14 used historically to determine what was going on at  
15 the site.

16 Q Okay.

17 A This reference, I put it in there  
18 implying that site data can be used, modeling can be  
19 used, statistical analysis can be used. So  
20 historical construction can be done many different  
21 ways.

22 Q Uh-huh. Are you familiar with this  
23 superfund record of decision?

24 A I remember reading it but I don't  
25 remember right now what it says.

1 Q Okay. Can you just go to the second  
2 page, the back of the first page?

3 A Okay.

4 Q And in the middle, there's a -- there's  
5 an abstract and it's box 16.

6 A Okay.

7 Q Okay.

8 MS. BAUGHMAN: Sorry. What page are  
9 you on?

10 MS. O'LEARY: The back of the first  
11 actual page of the document. It doesn't  
12 have a number. It's --

13 THE WITNESS: The ab- --

14 MS. O'LEARY: There are boxes on it.  
15 Yeah.

16 THE WITNESS: The abstract you are  
17 referring to?

18 MS. O'LEARY: Uh-huh.

19 THE WITNESS: Okay.

20 MR. DEAN: Can I see it for a  
21 second?

22 BY MS. O'LEARY:

23 Q Okay. So --

24 MS. BAUGHMAN: That's -- yeah.  
25

1 BY MS. O'LEARY:

2 Q So the abstract says that, "The Tucson  
3 International Airport area site encompasses sections  
4 of southwest Tucson and adjoining land south of the  
5 city of Pima County, Arizona -- or the city in Pima  
6 County, Arizona.

7 "The site is located in the Tucson basin  
8 and includes industrial, commercial, residential and  
9 undeveloped areas as well as the Tucson  
10 International Airport, the U.S. Air Force Plant  
11 number 44, AFP 44, and part of the San Xavier Indian  
12 Reservation. The Santa Cruz River borders the site  
13 to the west.

14 "The groundwater system in the Tucson  
15 basin has been designated as sole source aquifer.  
16 Before the discovery of groundwater contamination in  
17 the TAA wells within the site boundaries provided  
18 water for over 47,000 people. At least 20  
19 facilities have operated in the TAA since 1942.  
20 These include aircraft and electronics facilities  
21 which discharged waste liquids directly to surface  
22 soil.

23 "Fire drill training areas where  
24 uncombusted residual wastes from training operations  
25 were left in unlined pits and unlined --



1 (Whereupon, the court reporter  
2 requests clarification.)

3 BY MS. O'LEARY:

4 Q -- "and unlined landfills which received  
5 various wastes from several sources. The first  
6 indications of groundwater contamination in TAA  
7 appeared in the early 1950s when elevated levels of  
8 chromium were detected in municipal supply well  
9 adjacent to AFP44 in the southern portion of the  
10 site and residents in another area complained of  
11 foul smelling water from private supply wells. In  
12 1976 the well was closed at AFP 44 by the state  
13 because of high levels of chromium.

14 "By 1988, additional sampling by the Air  
15 Force and EPA had indicated the presence of VOCs in  
16 the groundwater. Consequently, in 1981, the City of  
17 Tucson began closing all municipal wells that  
18 exceeded the state action level for the principle  
19 contaminant TCE and notified private well users of  
20 potential risks.

21 "The site was divided approximately in  
22 half along Los Reales Road with the Air Force" --

23 (Whereupon, the court reporter  
24 requests clarification.)  
25

1 BY MS. O'LEARY:

2 Q "Los Reales Road with the Air Force  
3 addressing contamination to the south and EPA  
4 addressing contamination to the north.

5 "In 1987, the Air Force began operating  
6 its groundwater pump and treatment system using ion  
7 exchange and packed column aeration followed by  
8 reinjection into the aquifer. This rod addresses  
9 the groundwater contamination in the northern  
10 portion of the site which, together with the Air  
11 Force remedial groundwater system, constitutes the  
12 overall groundwater remedy for the site.

13 "The northern portion of the site has  
14 been divided into two discrete areas, A and B. Area  
15 A lies west of the airport and extends approximately  
16 three and a half miles to the northwest in the  
17 direction of groundwater flow and is generally less  
18 than a mile wide.

19 "Area B consists of two smaller separate  
20 areas north of the airport. It fur -- it further --  
21 if further investigations indicate that there is  
22 soil contamination and that it is a source of  
23 continuing groundwater contamination, a rod will be  
24 developed to address soil remediation. The primary  
25 contaminants of concern effecting groundwater are

1 VOCs including TCE, benzene, and xylene."

2 So is this project also about  
3 remediation?

4 MR. DEAN: Object to the form. The  
5 document speaks for itself.

6 A Yeah, it is about remediation --

7 BY MS. O'LEARY:

8 Q Okay.

9 A -- but there is some population --  
10 there's a mention of population living in the  
11 vicinity of about what, 50 -- 47,000 people.

12 Q Yeah.

13 A So I don't know how they would resolve  
14 the contaminant distribution, remediation, or they  
15 don't want to look at the health effects maybe of  
16 whatever --

17 Q I mean --

18 A Whatever --

19 Q Go ahead.

20 A Whatever the decision is for U.S. EPA or  
21 U.S. -- who is doing this? I remember --

22 Q So --

23 A This is the -- this is the record of  
24 decision. Okay.

25 So I think they are looking at

1 remediation here.

2 Q Is there any discussion here of  
3 historical reconstruction of a water model?

4 A Well, I think they -- as I said, the  
5 water modeling analysis can be done looking at model  
6 outputs, statistical outputs, or site data.

7 The reason I have included this reference  
8 is that this reference doesn't use modeling, it just  
9 looks at the site data and tries to understand how  
10 they can manage the system for remediation without  
11 doing a modeling. As far as I know, that's the  
12 purpose I put that in there.

13 Q Okay.

14 MS. O'LEARY: All right. That is  
15 it. I'm all finished.

16 Thank you, Dr. Aral --

17 THE WITNESS: Okay.

18 MS. O'LEARY: -- or Professor Aral.

19 THE WITNESS: Thank you.

20 MR. DEAN: No questions.

21 MS. O'LEARY: Okay.

22 MR. DEAN: Have a good evening.

23 MS. O'LEARY: Then we are done.

24 THE VIDEOGRAPHER: The time right  
25 now is 5:16 p.m. We are off the record.

(Thereupon, the deposition was  
concluded at 5:16 p.m. EST.)

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C E R T I F I C A T E

I hereby certify that I am a Notary Public,  
in and for the State of New York, duly commissioned  
and qualified to administer oaths.

I further certify that the deponent named in  
the foregoing deposition was by me duly sworn, and  
thereupon testified as appears in the foregoing  
deposition; that said deposition was taken by me  
stenographically in the presence of counsel and  
reduced to typewriting under my direction, and the  
foregoing is a true and accurate transcript of the  
testimony.

I further certify that I am neither of  
counsel nor attorney to any of the parties to said  
suit, nor am I an employee of any party to said  
suit, nor of any counsel in said suit, nor am I  
interested in the outcome of said cause.

Witness my hand and seal as Notary Public  
this 10th day of February, 2025.



Clifford Edwards

New York Notary ID Number: 01ED6430906

Notary commission expires: 3/28/2026

J U R A T

I have read the foregoing 381 pages and hereby  
acknowledge the same to be a true and correct record  
of the testimony.

\_\_\_\_\_  
MUSTAFA MEHMET ARAL

Subscribed and sworn to

\_\_\_\_\_.

Before me this \_\_\_\_\_ day of \_\_\_\_\_,  
2025.

\_\_\_\_\_  
Notary Public

My Commission Expires:

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